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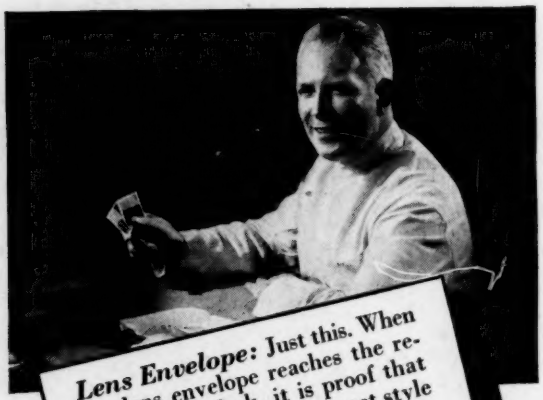

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AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 24 JANUARY, 1941 NUMBER 1

KERATOPLASTY*

COMMENTS ON THE TECHNIQUE OF CORNEAL TRANSPLANTATION. SOURCE AND PRESERVATION OF DONOR'S MATERIAL. REPORT OF NEW INSTRUMENTS

RAMÓN CASTROVIEJO, M.D.
New York

It is encouraging to read the increasing number of reports on keratoplasty in recent scientific publications, a demonstration of the interest in the study of this special field of ophthalmic surgery. Many completely studied successful cases of corneal transplantation have already been reported. These further justify the permanent position of keratoplasty in ocular surgery.

However, in surveying the literature on corneal transplantation, one is struck with the large number of inadequately and incompletely reported cases. In many instances the period of observation after operation is too short to permit a fair or true conclusion. In some reports, from the incomplete study of one or a few cases, invalid conclusions and generalizations are made. Some authors have brought forward new instruments or techniques, claiming for them advantages that are not justified. Frequently the number of cases studied is too small, the postoperative period of observation too short, and the results of operation are too poor to warrant such dogmatic assertions and conclusions. The publication of these incomplete studies, as well as the dogmatic assertions empirically made without practical knowledge of the subject, confuse the problem of corneal transplantation instead of clarifying it, discouraging those beginners who fail to obtain the success claimed by the authors.

It is my purpose now to present in a series of articles my experiences with corneal transplantation, based upon almost 400 keratoplasties in animals and more than 200 in human beings. The articles will be written in detail, discussing at length (1) the causes which brought about changes in my technique, (2) the source and preservation of donor's material, (3) a report of different instruments devised with the purpose of improving or simplifying the operation, (4) the statistics of 200 keratoplasties, (5) the selection of cases for keratoplasty, (6) complications during the operation and postoperative course, (7) the operations intended to improve unfavorable cases, rendering them more favorable for corneal transplantation, with special reference to handling of densely vascularized corneal opacities, whether due to disease or to trauma, and (8) keratoplasty for cosmetic purposes, as compared with corneal tattooing and contact glasses.

It is hoped that the detailed report of my experiences will spare those interested in this subject the failures resulting from the application of the operation in cases in which it was contraindicated. Also, the presentation of all the instru-

*From the Institute of Ophthalmology, Columbia Presbyterian Medical Center. Aided in part by a grant from the Francis I. and Elizabeth C. Proctor Fund.

ments that were devised for keratoplasty, whether or not found adequate, will prevent their duplication and perhaps lead to the creation of more effective ones. The articles will refer to the work of other authors when comparison may be necessary, to make clear certain points of the presentation.

In the present article, the following points will be covered: 1. Brief review of literature on keratoplasty, with special reference to the factors leading to my present techniques. 2. Description of my methods of square and circular partial penetrating keratoplasties. 3. Remarks on some methods of partial penetrating autokeratoplasty. 4. Source and preservation of donor's material. 5. Report of instruments devised for keratoplasty.

Brief review of literature on keratoplasty, with special reference to the factors leading to my present techniques

A historic study of keratoplasty made by the author in 1932 showed that successful results could be obtained only when autoplastic or homoplastic material was used. Of the different techniques used until then, total and lamellar types of keratoplasty were decidedly inferior to the partial penetrating type. Those interested in a more detailed discussion of the different types of keratoplasty are referred to my previous publications. In this article only those methods found to give most successful results will be discussed in detail. No mention will be made in this article of recently reported methods of keratoplasty or modifications of older ones, because the reports are too incomplete and premature to permit judgment of their value.

A critical study of all the techniques of partial penetrating keratoplasty used until 1932 showed that the method of Von Hippel, more or less modified by Zirm, Elschnig, Filatov, and Thomas, has given by far the best results. In order to understand better the rest of the presentation, a brief description of the five techniques just mentioned follows:

(a) Von Hippel's technique: In 1887 Von Hippel described his operation of partial penetrating keratoplasty (fig. 1 A.) in which a motor-driven trephine was used to obtain a graft of the same size and shape as the defect made with the same trephine for the removal of the opacity in the cornea of the host. The transplant was not sutured, but kept in position by pressure of the eyelids only.

(b) Zirm's technique: In 1906 Zirm operated on one patient with a leucomatous cornea as the result of a lime burn, using Von Hippel's trephine. The graft was held in position with cross sutures inserted in the conjunctiva, close to the limbus (fig. 1 B.).

(c) Elschnig's technique: Elschnig's technique is a slight modification of Von Hippel's (fig. 1 C.). Von Hippel's trephine of from 4 to 5 mm. in diameter is used to remove from an opaque cornea a disc of full thickness, which is replaced by a similar disc of transparent cornea. A bridge suture is placed from the conjunctiva of the upper limbus over the transplant and tied in a similar position to the conjunctiva of the opposite side. Physostigmine salicylate is used before the operation in order that the pupil will be contracted, protecting the lens from possible injury.

(d) Filatov's technique: Filatov has modified Von Hippel's operation, trying to eliminate its disadvantages; namely, the imperfect way in which the transplant is held in position and the unfortunate ease with which the iris and the lens can be injured with the trephine. A flap is made in the upper bulbar conjunctiva (fig. 1 D.). An incision is made in the lower bulbar conjunctiva near the lower

limbus. With a cataract knife, a puncture and a counterpuncture are made in the cornea, leaving, therefore, two parallel perforating incisions through which a strip of celluloid (prophylactic spatula) is passed, penetrating the anterior chamber and separating the cornea from the iris and lens. The cornea is trephined, and a transparent graft, taken from an eye of a patient or from an eye enucleated from a cadaver shortly after death, is placed in position. The conjunctival flap, with its epithelial surface downward, is stretched over the transplant and fastened with two sutures to the incision in the lower part of the conjunctiva near the

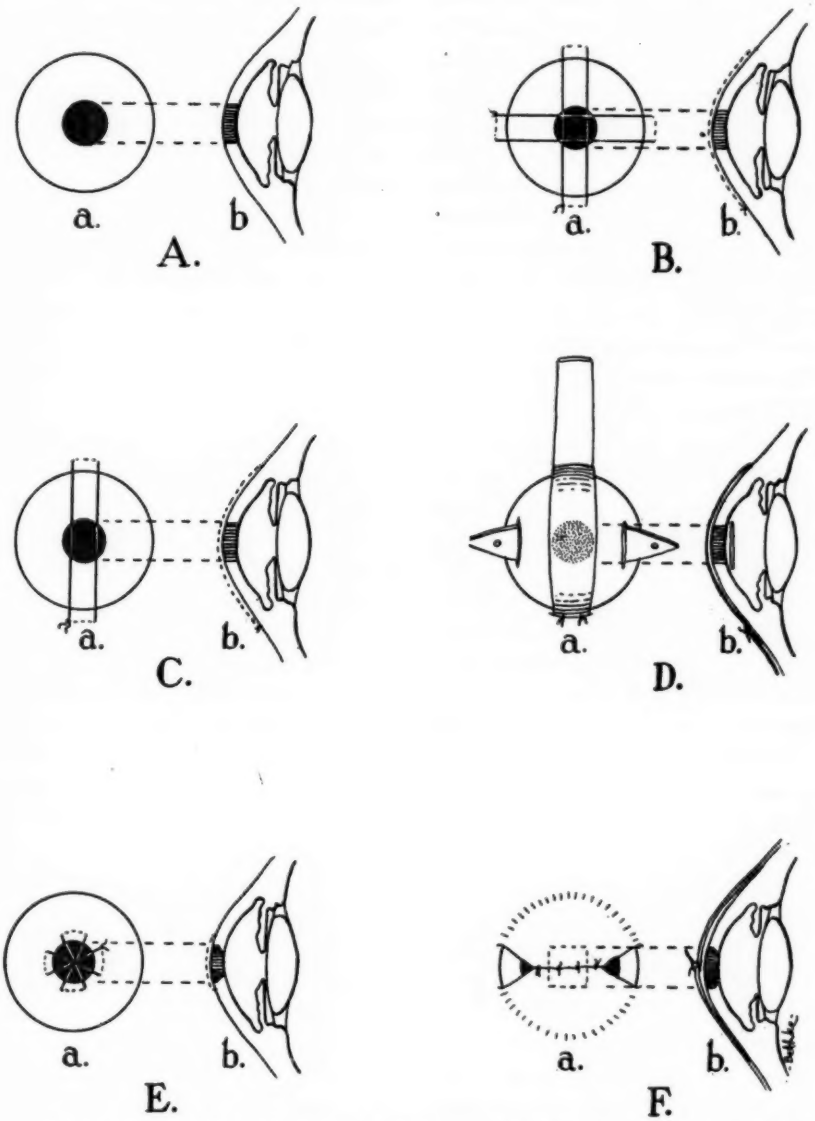

Fig. 1 (Castroviejo). Techniques of circumscribed penetrating keratoplasty: A., Von Hippel's; B., Zirm's; C., Elschnig's; D., Filatov's; E., Thomas's; F., my technique (1932).

limbus. The strip of celluloid is then removed. In case it is impossible to use the conjunctival flap because of scar tissue, a small round piece of the membrane of a boiled egg, with its inner surface toward the implant, is used instead. Radial incisions are made in this membrane for better fitting, and bridge sutures in the manner of Elschnig are placed vertically and horizontally for fixation of the egg membrane and the implant. More recently Filatov has devised a combination of a hand trephine with a safeguarding spatula (Filatov and Marzinkowsky), which facilitates the performance of his operation.

(e) Thomas's technique: A trephine of 4 to 4.5 mm. in diameter is used to outline a disc in the leucomatous cornea (fig. 1 E). Then the trephine is sloped to about 45 degrees and rotated so as to cut through at one point. Through this point one blade of a pair of scissors penetrates into the anterior chamber, and the remaining inner layers of the outlined corneal flap are cut in a shelving manner, so that the endothelial aspect of the disc is smaller than the epithelial surface. With a trephine slightly smaller than the one used upon the host, a similar disc is obtained from a transparent donor's cornea. The leucoma is replaced by the graft and is kept in position by cross stitches previously inserted into the cornea a short distance from the graft itself. Thomas attaches considerable importance to the size of the transplant in its relation to the size of the defect. The transplant should be smaller than its bed, since the former, according to Thomas, undergoes some swelling, and if it is originally of the same size as the latter, the result is a bulging cicatrix with irregular edges. In Thomas's technique the transplant is firmly held in position with cross stitches. The shelving of the transplant prevents its falling into the anterior chamber, and a dilated pupil prevents anterior synechiae. The transplant is obtained from the eye of a patient, and is kept in physiologic solution of sodium chloride for a short time before it is finally placed in the eye of the host.

The status of keratoplasty in 1932 was summarized by the author in the following conclusions:

1. The transplant must be taken from the same individual (autoplasty) or from individuals of the same species (homoplasty). Heterotransplants invariably become opaque.

2. Material can be obtained from living patients who have lesions which require enucleation, but whose corneas are normal, or from cadavers of adults or infants shortly after death. If it is possible to obtain them, eyes of young persons are more suitable for the operation.

3. The implant, after it has been dissected, can be preserved in dry gauze for immediate transplantation, or in different liquids, such as physiologic solution of sodium chloride or hemolyzed serum, in which case it is not necessary to act so expeditiously. The sooner the transplantation is performed after the implant has been dissected from the eye, the less danger there will be of degeneration of the finer structures, such as endothelium.

4. Total keratoplasty can be employed in exceptional cases when it is not possible to perform other methods of operation. This, at best, offers only temporary improvement of vision, for the implant invariably becomes opaque from secondary glaucoma or phthisis bulbi.

5. Lamellar keratoplasty is applicable only in cases in which lesions are very superficial. Superficial lesions rarely extend over the whole surface of the cornea; when they are so extensive, they may make this type of operation necessary for visual purposes. Usually, a less

complicated operation, such as iridectomy, would serve the same purpose. The necessary proliferation of connective tissue in the place corresponding to the base of the cicatrix contributes to the formation of a certain degree of haziness of the implant which it is impossible to eliminate.

6. Circumscribed, penetrating keratoplasty produces the best permanent results, and is the only method that offers hope.

7. Scissors, forceps, and sutures traumatize the implant and favor its opacification.

8. Transplants must correspond exactly with the defect. It is absolutely necessary to have perfect coaptation of the edges of the transplant with the edges of the cornea of the host. This cannot be obtained by the use of knives and scissors, and requires the aid of some mechanical device which will solve the problem of size of the transplant in relation to the defect in the cornea of the host.

9. The trephine used to cut the full thickness of the cornea, as in the method of Von Hippel, or the superficial layers only, finishing the incision of the deeper layers with scissors, as in the method of Thomas, has solved the problem of size and form of the transplant.

10. The transplant must be held in position with the help of sutures. These should not be inserted in the transplant itself, but in the conjunctiva, as in the methods of Elschnig and Zirm, or with cross stitches in the cornea, as in the technique of Thomas.

11. When operating after the method of Von Hippel, the pupil must be contracted fully in order to avoid injury to the lens, and it must be completely dilated when operating by the method of Thomas, to avoid anterior synechiae.

12. Local anesthesia is to be preferred to general anesthesia because the latter exposes the patient to postoperative vomiting, which threatens the success of the operation.

13. Good results have been obtained by Elschnig, using a trephine of the same size for the donor and for the host, but Thomas advised the use of a slightly smaller trephine for the donor than for the host.

With the purpose of familiarizing myself with the different techniques just described, I made in 1931 a practical study of these operative methods upon rabbits' eyes. The following observations, published in 1932, were made:

In the course of the experiments using Elschnig's technique, the following technical difficulties were found: It is difficult, if not impossible, to hold the trephine absolutely perpendicular to the cornea without exerting uneven pressure. Perforation of the anterior chamber does not take place, in most cases, in a uniform manner, all around the corneal disc. It is, therefore, necessary, as soon as the anterior chamber has been perforated, to withdraw the trephine and finish the dissection of the disc with scissors or with a knife, in order to avoid injury to the iris or lens. Such injury is easily made with the trephine, especially if it is motor-driven, as soon as the anterior chamber has been opened and the cornea collapses. The necessity of using eserine to protect the lens from injury by the trephine favors incarceration of the iris. Another weak point found in the operation of Von Hippel as practiced by Elschnig is the way of holding the transplant in place by passing the bridge suture over the graft and inserting it in the bulbar conjunctiva. The pressure is not evenly applied over the whole surface of the graft, but is exerted mostly along the two lines produced by the sutures passing over it, the uneven tension favoring detachment

of the transplant. (Elschnig reported 22 cases out of 174 keratoplasties in human beings in which the graft was detached and the closure of the hole made by the trephine had to be accomplished eventually by means of a conjunctival flap.) Not infrequently, the sutures, as soon as they become somewhat loose, will slip sidewise with a tendency to become incarcerated between the edges of the implant and the cornea of the host, thereby they become somewhat loose, will slip completely off the graft, in which case the graft is held in position by the pressure of the lids only. The method of cutting with trephine, without beveling the edges, increases the possibility of the transplant's falling into the anterior chamber or, in aphakic eyes, into the vitreous. The cross-bridge suture advocated by Zirm to hold the graft in position was found to possess slight, if any, advantages over that of Elschnig. Both the Zirm and Elschnig methods of holding the graft in position were found, however, more effective than the pressure of the lids alone, as advocated in Von Hippel's original operation.

The advantages claimed in Filatov's technique were found to be offset by the disadvantages of the two extra incisions made to insert the prophylactic spatula. The two additional openings encourage incarceration of the iris. Besides, it is not a rare occurrence during the performance of the puncture, counterpuncture, and introduction of the prophylactic spatula into the anterior chamber, to traumatize the iris and lens, which are the accidents that the author tries to prevent. Experimenting on rabbits with Filatov's technique, the conjunctival flap with the epithelium facing the transplant was found to have a marked tendency to become infected early during the postoperative course. It seemed to me, comparing Elschnig's and Filatov's methods, that the procedure advocated by the latter was much more complicated, with slight, if any, advantages over that of Elschnig.

Thomas's technique of cross stitches and beveled graft was found to possess more advantages than the ones previously described. There were, however, some details which seemed to me subject to improvement, such as the way in which beveling was accomplished, as well as the manner of holding the graft in position. Beveling of the graft and cornea of the host in Thomas's operation was thought to have decided advantages over the previous ways of cutting the edges of the cornea at right angles. The beveling with scissors of a small circle 4 or 4½ mm. in diameter presented certain difficulties. The necessity of combining for the dissection of such a small disc a trephine and multiple sections with scissors, was apt to give an irregular outline of the edges both in the cornea of the host and in the graft. It was then believed that, if instead of using a combination of a trephine and scissors, cutting along a small curved incision, it would be possible to make straight incisions with a combination of knife and scissors, the operation might be simplified, the procedure easier to carry out, and the edges of the incision might present a more regular and a cleaner outline.

In regard to the way of holding the graft in position by the method of Thomas, as well as those of Elschnig, Zirm, and Von Hippel, it seemed that none of them followed the principles laid down by Von Graefe, who stated that an eye should not be opened through the cornea without covering the incision with a conjunctival flap. Since the cornea is an avascular tissue, nutrition of the transplant must necessarily be very poor if vascularization does not take place. This fact seemed to explain, in the statistics of

Elschnig, the high percentage of successful transplants in cases of parenchymatous keratitis, and the small proportion of successes in other conditions such as burns, dense leucomas, and the like, in which nutrition of the cornea was not increased, but rather, in most cases, diminished.

In order to correct what were considered deficiencies of the methods already mentioned, a new operation was devised (fig. 1 F.) with the following characteristics: (1) straight incisions instead of curved ones; (2) beveled edges; (3) holding the graft in place with conjunctival flaps.

The problem of straight incisions, as well as of the equal size of graft and dissected leucoma, was solved with the use of a double-bladed knife (fig. 2 A.). The distance between the blades could be adjusted to obtain different sizes of transplants. The double-bladed knife was used to outline the graft and the leucoma to be dissected. Penetration into the anterior chamber was accomplished with a special keratome (fig. 2 B.), and the incision completed with special scissors (fig. 2 C.). Both keratome and scissors were held at an angle of 45 degrees, in order to obtain a beveled graft with the inner

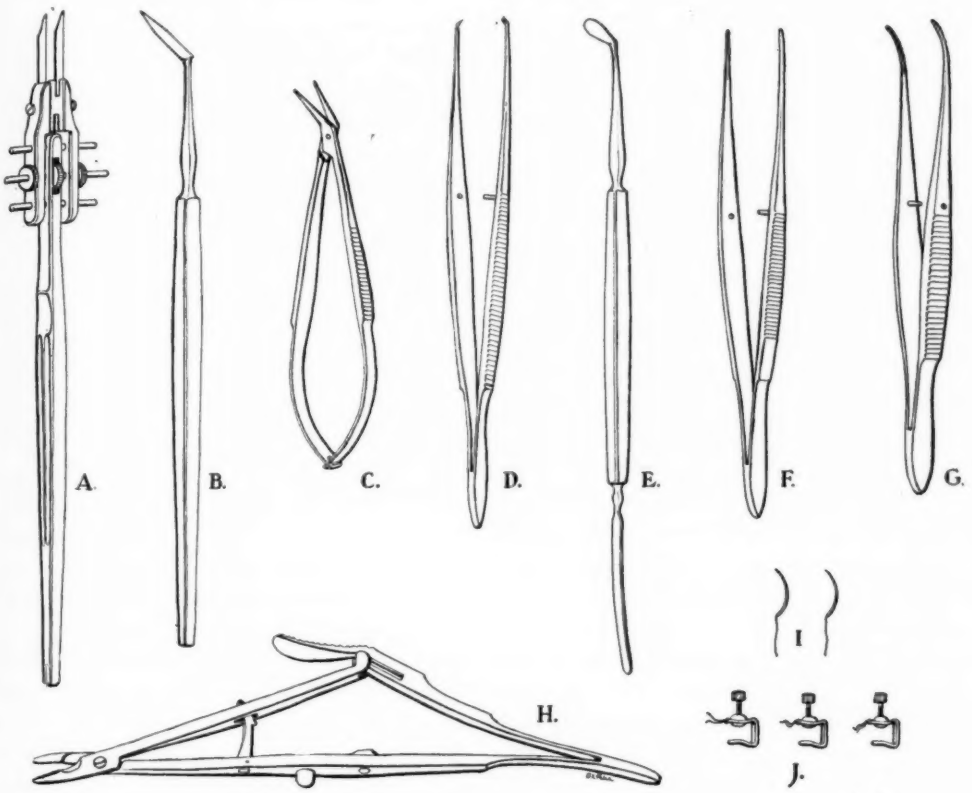

Fig. 2 (Castroviejo). Instruments required for author's method of square partial penetrating keratoplasty.*

* The instruments for keratoplasty are manufactured by V. Mueller and Company, Ogden Avenue, Chicago, Illinois, and E. B. Meyrowitz, 520 Fifth Avenue, New York City; the sutures by Davis and Geck, Inc., Brooklyn, New York.

surface smaller than the outer surface. Once the graft was in place, it was held in position with two conjunctival flaps, dissected from the upper and lower bulbar conjunctiva, and sutured in the center of the cornea along the horizontal diameter.

The operation was tried first on 40 rabbits with normal corneas and, after a few improvements in technique, on 30 more rabbits with leucomatous corneas. The encouraging results obtained in rabbits' eyes justified the application of the operation to humans. Seven unselected cases of corneal opacities in humans were chosen for operation. Of these, three grafts remained clear, one became nebulous, two became opaque, and the seventh eye was lost from a purulent infection.

In the summary of the report of the first seven human cases, my technique was found to have the following distinctive characteristics: (1) A rectangular graft, 4 mm. square, corresponding exactly in size and beveled edges in both the transplant and its bed in the recipient's cornea, with the anterior surface of the graft larger than the posterior surface. (2) The use of conjunctival flaps to hold the transplant in position, giving a gentle, uniform pressure, accelerating the process of healing, and furnishing necessary nutrition while cicatrization was taking place during the first few days. The conjunctival flaps also made a watertight union, favoring the restoration of the anterior chamber and giving protection to the graft and to the eye, in case the graft failed to heal completely along its four edges.

Since that time, more than 200 keratoplasties on human beings have been performed at the Institute of Ophthalmology, Columbia Presbyterian Medical Center. In the first 21 operations, conjunctival flaps alone were used to hold the transplant in position. A few more were performed with a combination of corneal sutures and conjunctival flaps. During the past three years, the conjunctival flap has been eliminated entirely, the transplant being held in position with a continuous corneal suture.

A better knowledge of the subject, gained by the practical study of the operation in many different types of corneal opacities, brought about the necessity of modifying the technique. Often changes of technique were carefully studied in animals before they were applied to the human eye.

A detailed discussion of my original technique and its subsequent modifications follows. The different points of the surgical procedure will be discussed separately.

Author's original technique

Shape of the graft. In 1931, operating with trephine and scissors upon animals' corneas, and studying microscopically the incisions thus made, I found that the cutting of the whole thickness of a complete disc of cornea can rarely be obtained with the aid of a trephine. When a trephine is used for such purpose, the anterior chamber is almost always perforated at one portion of the circumference of the disc, with the subsequent collapse of the cornea and the impossibility of continuing the trephining without danger of injury to intraocular structures. Once the anterior chamber has collapsed, the completion of the incision has to be accomplished with scissors. Beveling of the graft and cornea of the host seems to be a desirable feature to prevent the graft from falling into the anterior chamber, or vitreous cavity, in case of aphakia. Beveling of the graft and cornea of the host when the trephine is used has to be accomplished with the aid of scissors, as soon as the trephine has entered the anterior chamber. Upon experimenting with different

sizes of transplants, it was found that the cutting of the edge of circular grafts with scissors became progressively more difficult as the diameter of the circle diminished. A microscopic study of sections made with the trephine alone disclosed that the edges were irregular. Microscopic sections of beveled grafts made with a trephine-scissors combination were found to have the edges still more irregular than those made with the trephine alone.

Microscopic sections of straight perforating corneal incisions were then studied. These were made with knife-keratome and knife-scissors combinations, and were found to have cleaner edges than those made by the trephine-scissors combination.

After experimenting upon animal eyes, I found the double-bladed knife to be very effective. The blades, very sharp, made of the best razor-blade material, could be easily tested before each operation by the same method employed to test cataract knives.

The double-bladed knife is used to outline and incise the square in the cornea of both donor and host without penetrating into the anterior chamber. The anterior chamber is entered with a special keratome along one edge, and the rest of the edges are cut with the desired degree of beveling with special scissors. The combination of double-bladed knife and scissors, especially in regard to beveling the edges, has been found to be easier to use than the trephine-scissors combination. The blades of the knife are more easily tested and replaced than those of trephines. The double-bladed knife offers more flexibility than does the trephine. In removal of grafts of different sizes, trephines of different diameters are needed, while the adjustable double-bladed knife permits use of this one instrument for different sizes of graft.

Finally, the double-bladed knife can be used to outline several grafts in the donor's eye to greater advantage than can the trephine. With the trephine only one graft can be obtained from each eye. The eye collapses after the first corneal disc has been obtained, making it very difficult or impossible to use the trephine again to obtain more grafts. The use of operculums to occlude the openings made in the cornea is not satisfactory. With the double-bladed knife, several grafts can be outlined and removed from the cornea of the donor. This can be done by cutting with special corneal scissors along the previously outlined incisions after the first graft has been removed in the usual manner.

Size of the graft. The graft may vary in size between 4 and 6½ mm. If the graft is smaller than 4 mm., the proliferation of connective tissue during the healing process may include the small central area of the graft, with subsequent failure of the operation for visual purposes. It is not infrequent to observe along the edges of cicatrization of corneal grafts an area of nebulosity, resembling the cloudiness which sometimes is left in the cornea by imbedded foreign bodies. In corneal grafts, the nebulosity may be due mostly to excessive proliferation of connective tissue in the stroma within the edges of the graft, to wrinkling of Descemet's membrane, or to excessive proliferation of endothelial cells which partially or totally cover the posterior surface of the graft, in the form of a pseudomembrane.

If the graft is larger than 5 mm., there is danger of incarceration of the iris between the graft and cornea of the host. If the pupil dilates well, or if preliminary iridectomy has been performed, leaving a large coloboma of the iris, grafts as large as 6½ mm. can be used. These will cicatrize without danger of incarceration of the iris. In keratoconus cases, the graft

should not be smaller than 5 mm., in order to include as much as possible of the area of thin cornea. If a graft smaller than 5 mm. in size is used in keratoconus, there is a tendency to ectasia, with resultant high myopia or astigmatism. Grafts larger than 6½ mm. are not practicable because they are not easily held in position, portions of the edges have more tendency to protrude than is the case with smaller grafts, and incarceration of the iris with subsequent cloudiness of the graft and secondary glaucoma is not rare. The ideal size for a graft centrally placed in an eye with a normal anterior chamber and round pupil is 4½ mm.

Size of the graft in relation to the opening in the cornea of the recipient. Both experimentally on animals and clinically on human beings, it was observed that healing of the transplant was best obtained when the transplant was of the same size as the defect in the leucomatous cornea of the host. Healing took place in these cases without manifestation of a tendency to swelling of the transplant. The transplant appeared clear during the first few days after the operation. In no instance, when the apposition of the edges was perfect, did the transplant evidence a tendency to protrude. When the transplant was larger than the defect in the cornea of the host, it had a tendency to protrude, and unless the sutures were placed loosely they pressed on the transplant, frequently causing permanent cloudiness in the anterior layers. If the transplant was smaller than the opening made in the cornea of the host, it was observed microscopically in animal eyes that the edges of the graft were not in perfect apposition with the edges of the host's cornea, particularly the endothelium and Descemet's membrane. The latter had a tendency to curl inward, leaving a gap of unprotected corneal stroma which quickly filled with fibrin. If the iris came in contact with this fibrinous material, anterior synechiae developed. The transplant appeared more edematous and swollen in these cases during the first few days after the operation than in the two previously described instances, perhaps due to the imperfect apposition of the edges which permitted the entrance of aqueous humor into the corneal stroma. This cloudy and edematous appearance of the graft was particularly pronounced, as observed both clinically and microscopically, in those cases in which incarceration of the iris took place.

Location of the graft. Whenever possible, the graft ought to be located in the center of the cornea because this location seems to be the most desirable for visual purposes. However, if the leucoma is extensive and placing the transplant in the center of the cornea would mean that the graft would be completely surrounded by connective tissue, the transplant may be displaced towards the periphery of the cornea to get as much of the healthy cornea of the host as possible in contact with the graft. When the graft is entirely surrounded by leucomatous cornea of the host, it has a tendency to become either nebulous or opaque. The tendency to opacification is in direct proportion to the density of the scar tissue in the leucomatous cornea of the host. In cases in which a large iridectomy has been performed, it is advisable to place the transplant to correspond with the surgical coloboma, decreasing in this manner the danger of anterior synechiae.

Beveling of the edges of both graft and cornea of the host. As the result of experimental work on animals with normal and leucomatous corneas during 1931 to 1933, beveling of the edges of both graft and host was found to be a desirable feature, possessing over the right-angle edges the following advantages: (1) to prevent the graft from falling into the

anterior chamber; (2) increased surfaces of contact, thus increasing nutrition and favoring healing.

The beveling of 45 degrees, as first advocated, was soon found to be excessive; for with this degree of beveling (especially when the apposition of the edges was not perfect) the intraocular pressure, added to the swelling of the edges of both the graft and cornea of the host, had a tendency to push the transplant outward, with subsequent protrusion, impaired healing, and swelling of the graft (fig. 3 A.). In order to avoid protrusion of the graft in these instances, it was necessary to tie the sutures more firmly. These, in turn, pressing upon the graft, had a tendency to macerate it excessively, leaving permanent opacities in the superficial layers. When the graft protruded somewhat, healing was delayed because of excessive proliferation of connective tissue at the uneven edges. A 45-degree bevel resulted in a relatively small posterior portion of the graft, a broader scar, and a reduced area of possible clear graft. A further reduction of the posterior surface of the graft available for visual purposes takes place by the curling inward of Descemet's membrane and endothelium in the cornea of both the host and the transplant. This tendency of the endothelium and Descemet's membrane to curl inward was observed in microscopic sections of rabbits' eyes and found to be more pronounced in the graft than in the cornea of the host. If, then, proliferation of connective tissue or endothelium, or wrinkling of Descemet's membrane at the edges is excessive, the reduced posterior surface of the graft available for visual purposes easily becomes more or less nebulous, defeating the success of the operation.

To eliminate the disadvantages and technical inaccuracies enumerated, after successive modifications, the following technique was evolved (fig. 3 B.):

The graft is dissected without beveling. In the cornea of the host, approximately from one half to two thirds of the outer layers are incised with the double-bladed knife, without beveling. The inner third is beveled about 20 degrees from the vertical plane. In this fashion, the inner surface of the graft of the same size as the outer surface is fully utilized for

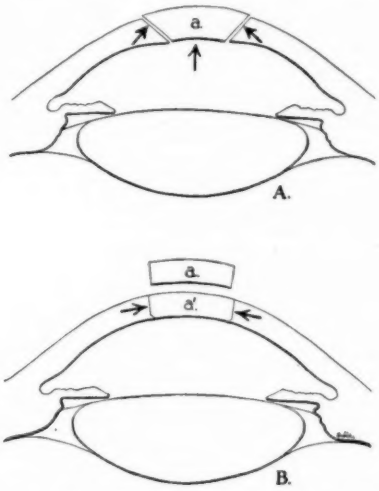

Fig. 3 (Castroviejo). A., beveled graft with arrows indicating tendency to displacement. B., graft without beveling (a) to replace leucomatous segment (a') with slight beveling.

cicatrization, with ample area of graft still left for visual purposes, allowing for an excessive proliferation of connective tissue or wrinkling of Descemet's membrane and endothelium at the edges.

The small inward slope made in the posterior portion of the cornea of the host is sufficient to prevent the graft from falling into the anterior chamber. At the same time, the projection of Descemet's membrane and endothelium of the host's cornea fills the gap produced by the curling of these structures in the graft. The snug fitting of the inner surfaces of graft and cornea of the host favors a prompt healing of the inner end of the incision by proliferation of endothelium, and the

early restoration of the anterior chamber with less danger of incarceration of the iris.

Conjunctival flaps. At first I used conjunctival flaps, thinking that they were the ideal means of applying uniform pressure on the transplant in order to hold it in position. It was believed that conjunctival flaps accelerated the healing process, nourishing the graft during the first few days after operation. However, after performing 21 operations on human eyes, a transplant became detached. After studying 21 keratoplasties performed with the use of conjunctival flaps, I was convinced that in some cases the conjunctival flaps did not maintain sufficient pressure to hold the transplant in position. This need for a securely fastened graft is particularly evident when the intraocular pressure is elevated, and the patient unruly. There are other instances when the conjunctival flaps failed to hold the graft in position, such as are found in patients with thin corneas (fig. 4 A.), like those found in keratoconus. Although a conjunctival flap protects the eye in case the transplant becomes detached, which occurred in one of my patients, it is too elastic and allows too much mobility of the graft, especially in unruly patients, with subsequent partial detachment of the graft, the conjunctival flap often becoming adherent to the partially detached edges. In some instances, the scarcity of the lower bulbar conjunctiva necessitated a more extensive dissection of the upper bulbar conjunctiva, leaving after cicatrization a certain degree of permanent ptosis. The use of conjunctival flaps also tends to leave the eye irritated, favoring infection and prolonging postoperative recovery. An eclectic method was used for some time, combining corneal sutures to hold the graft in position, and a conjunctival flap covering the sutures and graft, with the purpose of increasing nutrition and accelerating the process of healing. However, this modification was given up because of the following observations:

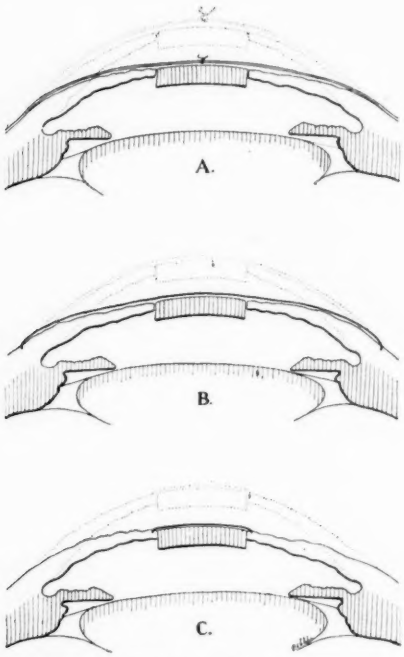

Fig. 4 (Castroviejo). Diagrams to show effect of conjunctival flaps and sutures in maintaining position of the graft in thin corneas. A., conjunctival flaps; B., suture from limbus to limbus; C., suture fastened to cornea adjacent to graft.

Under conjunctival flaps, it was found that the transplants remained clear during the early days following operation, justifying the belief that they were preserved under ideal conditions of nutrition. A high percentage of grafts in which corneal sutures were used instead of conjunctival flaps, presented during the first few days a diffuse, bluish-gray appearance, almost opalescent in some marked cases, due to edema. However, the ultimate fate of the transplant depends more on the nature of the surrounding tissue of the host than on the appearance of the graft during the first few days. If the transplant is surrounded by dense leuco-

matous cornea, which greatly impairs the nutrition of the graft, while it may look perfectly transparent for a few days or may remain so during a few weeks, it finally becomes either nebulous or opaque. On the other hand, when the graft is surrounded by host tissue preserving a great percentage of healthy corneal elements, the transplant may look edematous the first few days, if conjunctival flaps are not used; but generally the edema will disappear in from 6 to 8 days, the graft retaining thereafter a permanent transparency.

Corneal sutures. Following the already mentioned observations on conjunctival flaps, I shifted to the use of corneal sutures to hold the graft in position. The following observations were made during my use of this method.

Sutures, to hold the graft effectively in position, must be inserted into the cornea of the host, close to the transplant. If the sutures are placed far from the edges of the transplant or beyond the limbus, they have too much mobility and become loose shortly after their insertion, thus defeating the purpose of holding the transplant in position. In cases of very thin cornea (fig. 4 B.), such as keratoconus, or when other pathological processes have reduced the thickness of the cornea to one half, one third, or less of its normal thickness, the cornea collapses and wrinkles as soon as the anterior chamber is opened. The opening made in the cornea of the host becomes smaller than the graft, and the graft, although of the same size as the defect in the cornea of the host, appears larger and does not fit. In these instances, if the sutures to hold the graft in position are placed in the cornea far from the incision, or at the limbus, it is evident that the lack of resistance of the cornea to hold its normal shape and curvature will render the sutures ineffective, making it very difficult, if not impossible, to hold the transplant in place. On the other hand, if the sutures are placed near the incision (fig. 4 C.), the graft itself acts as a frame to hold the edges in good apposition, while restoration of the anterior chamber, normal curvature of the cornea, and healing take place.

If the sutures are placed through any part of the graft, partial or total opacification of the latter occurs. Care must be taken not to fasten the sutures too tightly, for if this is done they tend to press on the transplant, especially when it is edematous, and may cause a permanent nebulosity of its superficial layers. During the first 5 or 6 days after the operation, the sutures remain clean, but if they are retained too long, an ulcer or an abscess may form either in the cornea of the host or in the transplant, leading to its total opacification. Leaving the sutures too long tends also to irritate the eye, and encourages interstitial vascularization of the cornea of the host and the graft. It was thought that the use of some protective substance between the graft and the sutures, such as egg membrane or rubber tissue, might prevent maceration of the epithelium of the graft and allow the sutures to remain in place longer, thus giving the graft more time to heal. However, this procedure was given up because, if the sutures were left longer than six days, the protective substances did not prevent the formation of abscesses in the cornea of the host, irritation of the eye, and tendency to interstitial vascularization. Besides, without protective material the maceration of the epithelium is slight if sutures are not tightened excessively. The use of these protective substances was found to be a complication of the operation without any advantage. There was one more finding that showed that a slight maceration of the epithelium produced by a suture was of negligible import. This finding

was the permanent transparency of the graft obtained in two cases in which the graft was used without epithelial lining. In one of the cases the epithelium in the donor's eye was destroyed with iodine during the preparation of the operative field. In the second case the donor's eye was found to be without epithelium at the time of the dissection of the graft, due to excessive manipulation of the eye in the course of enucleation. In both instances, the epithelium of the graft was completely regenerated by the time the sutures were removed, six days after the operation.

At first the cross sutures advocated by Thomas were employed. These sutures, as devised by Thomas, had certain faults, namely:

(a) The tendency for one of the sutures to press upon the graft more firmly than the other, thus creating uneven pressure.

(b) The proximity of the knots to the incision. (Since then Thomas has modified his technique of cross stitching, preserving the two separate sutures, but inserting them in such a manner that the knots, when tied, will lie away from the incision.)

(c) The sutures did not apply any pressure upon the corners of the graft, which are the portions of the graft most likely to protrude.

To overcome the disadvantages mentioned in Thomas's cross sutures, a new continuous suture, as illustrated in figure 5, was devised. The new suture (a) provides the application of even pressure throughout. (b) It presses equally upon the graft at the corners and in the middle of the sides. (c) The knot of the suture may be tied either temporally or nasally, away from the edge of the transplant, in such a manner that it does not slide over the edge of the graft.

This continuous suture holds the graft in position so effectively that operation may be performed at any age, whether with local or general anesthesia. Local anesthesia is preferable; general anesthesia is used only in the case of children or of extremely nervous patients. Comparison of the results obtained by holding

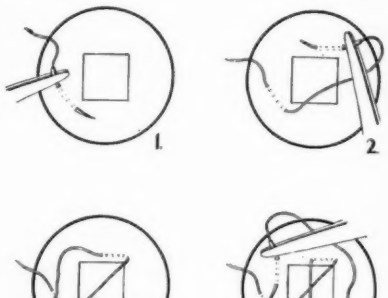

Fig. 5 (Castroviejo) Author's technique of continuous corneal suture for holding square graft in position.

the grafts in place with conjunctival flaps and with corneal sutures shows the latter method to be more effective, but only if the sutures are inserted in the host's cornea near the transplant.

The Author's Methods of Square and Circular Partial Penetrating Keratoplasties

Square Partial Penetrating Keratoplasty

After successive modifications of the surgical procedure, imposed by the experience gained in operating upon human beings and experimenting on animals, my latest technique of square partial penetrating keratoplasty is as follows. The

following description will contain only the procedure in uncomplicated cases. Handling of complicated cases, accidents during the operation and postoperative course, and their treatment will be discussed in another article.

Preparation of the patient. A detailed study of the patient's general condition is made, to eliminate foci of infection and other diseased states, in an attempt to bring the patient to the operation in an optimal condition of health.

The day before the operation, smears and cultures are taken from the conjunctival cul-de-sac. The importance that should be given to the results of these cultures is, as yet, a moot question. Hemolytic staphylococcus aureus has been found in many cases in which the operation was successful, without evidence of infection. On the other hand, this organism is a frequent cause of panophthalmitis. Hemolytic streptococci and pneumococci are found less frequently, and it would probably be prudent to delay the operation when these are present.

The night before the operation, 25-percent argyrol is instilled into the eye. An enema should be given, to prepare the patient for a postoperative course without abdominal discomfort. The day of the operation, two or three hours before the operation, phenobarbitol (0.09 gm. luminal) is given to the patient, a 25-percent solution of argyrol is instilled in the eye, and the pupil dilated with a 3-percent solution of atropine sulphate. Local anesthesia is preferable to general anesthesia, but in children and uncooperative adults the operation may be performed under general narcosis. If general anesthesia is used, instead of phenobarbitol, an injection of morphine solution with atropine sulphate is given (0.012 gm. morphine with 0.004 atropine), argyrol is instilled into the eye, and the pupil dilated with 3-percent atropine.

Instruments required for the operation (fig. 2). (a) Mosquito lid-clamp retractors (fig. 2 J.). Operating upon eyes with leucomatous corneas, it is sometimes difficult or impossible to use a speculum on account of the scarring of the conjunctiva, which greatly reduces the cul-de-sac. This is particularly the case in eyes with chemical burns. It is especially in these cases that the use of mosquito lid-clamp retractors was found effective. With two of them in the upper lid and one in the lower lid, an ample opening of the palpebral fissure is effected without pressure of the lids upon the globe. The retractors, provided with silk threads, are clamped with hemostatic forceps to the towels surrounding the operative field. The advantages of these lid retractors, as compared with specula or sutures inserted in the lids, are obvious, and have been discussed in another article.[9] (b) A double-bladed knife (fig. 2 A.), provided with detachable blades made of razor-blade steel. The blades are very sharp and should be tested before each operation on the kid skin drum, in the same manner as knives for cataract extraction are tested. They must be discarded if the points or the edges are not in good condition. A set of screws permits rapid regulation of the separation of the blades to the desired width. (c) Special keratome, 4 mm. wide (fig. 2 B.). (d) Special scissors of the spring type for cutting the cornea (fig. 2 C.), provided with dull points to avoid injury to the lens, and shaped in such a way as to make it easy to hold them at the desired angle to obtain beveling of the edges. (e) Elschnig's fixation forceps, which permit a good hold in the episclera while inserting the corneal sutures (fig. 2 D.) (f) Double spatula (fig. 2 E.). The narrow blade is used when manipulations

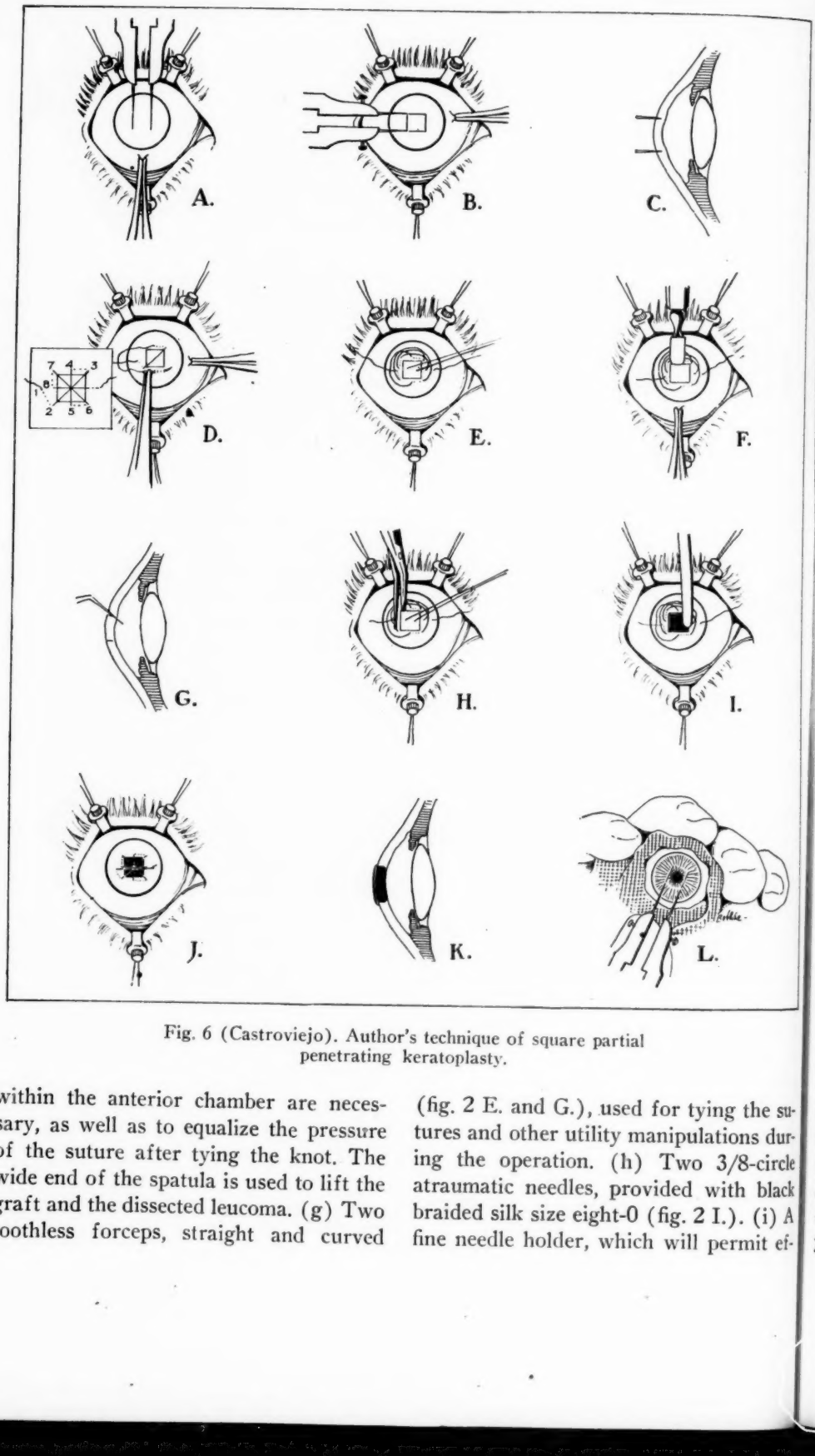

Fig. 6 (Castroviejo). Author's technique of square partial penetrating keratoplasty.

within the anterior chamber are necessary, as well as to equalize the pressure of the suture after tying the knot. The wide end of the spatula is used to lift the graft and the dissected leucoma. (g) Two toothless forceps, straight and curved (fig. 2 E. and G.), used for tying the sutures and other utility manipulations during the operation. (h) Two 3/8-circle atraumatic needles, provided with black braided silk size eight-0 (fig. 2 I.). (i) A fine needle holder, which will permit ef-

fective handling of the thin needles. The Kalt needle holder, or my modification of this (combination of needle holder and scissors, fig. 2 H.), has been found satisfactory for the handling of these fine sutures.

Surgical procedure. A routine preparation of the eye is made, about 15 minutes before the operation, with repeated instillations of a 4-percent solution of cocaine and a solution of adrenalin, 1 :1,000; immediately before the operation, a 20-percent solution of argyrol is again instilled, followed by another instillation of cocaine and adrenalin. Paresis of the orbicularis is induced, following Van Lint's technique. A retrobulbar injection of 1 c.c. of a 2-percent solution of novocaine and adrenalin, 1 :1,000, is given, and a few drops of cocaine, 2 percent, and adrenalin 1 :1,000, are injected above and below under the bulbar conjunctiva, with the double purpose of reinforcing the anesthesia when local is used, and obtaining a wider dilatation of the pupil, both with local or general anesthesia, without tendency to contraction after the anterior chamber has been opened. Separation of the eyelids is maintained with the mosquito lid-clamp retractors. The leucomatous area of cornea to be removed is outlined with a double-bladed knife without penetrating into the anterior chamber (fig. 6 A., B., C.). Fluorescein, 2 percent, is instilled to make the corneal incisions more visible, and facilitate the subsequent steps of the operation. A continuous corneal suture is inserted from 1 to 1½ mm. outside the edges of the outlined square (fig. 5 and fig. 6 D.). This suture is destined to hold the transplant in position. Another suture is inserted within the outlined leucoma to facilitate the removal of this segment (fig. 6 E.). One edge of the outlined square is cut through with a keratome kept at an angle of about 20 degrees from the vertical, in order to obtain shelving of the inner layers of the cornea (fig. 6 F. and G.). The keratome is placed so that one side of its blade cuts one corner of the outlined square. A blade of the scissors is then passed beneath the cornea into the anterior chamber at this point so as to cut straight along the adjoining uncut side of the outlined square. In order to prevent injury of the intraocular structures, it is not necessary to incise with the keratome one entire side of the outlined square, but only enough to open up a corner of this square, so as to permit entrance of one blade of the special scissors. The remaining uncut borders are cut in a shelving manner with about 20 degrees of beveling, with the aid of special scissors (fig. 6 H.). During this last manipulation, a gentle pull is exerted on the suture to keep the leucoma away from the lens, thus preventing injury to this structure. The transplant, equal in size and shape to the removed leucoma, is obtained in a similar manner (fig. 6 L.), but without shelving, from the enucleated eye of a patient or from the eye of a stillborn infant, enucleated shortly after delivery, or from the eye of a cadaver enucleated shortly after death. (The manner of preservation of donor's material, if the operation is not performed shortly after enucleation, will be discussed later.) If the operation is to be performed immediately or shortly after enucleation, the donor's material may be preserved in Ringer's solution or in physiologic solution of sodium chloride at room temperature. The clear transplant replaces the dissected leucoma (fig. 6 I.), and the continuous corneal suture is gently made taut (fig. 6 J. and K.), without exerting excessive pressure. The knot is tied at one side, away from the graft. Metaphen or any other nonirritating antiseptic ophthalmic ointment is placed in the conjunctival sac, and a binocular bandage is applied, without pressure.

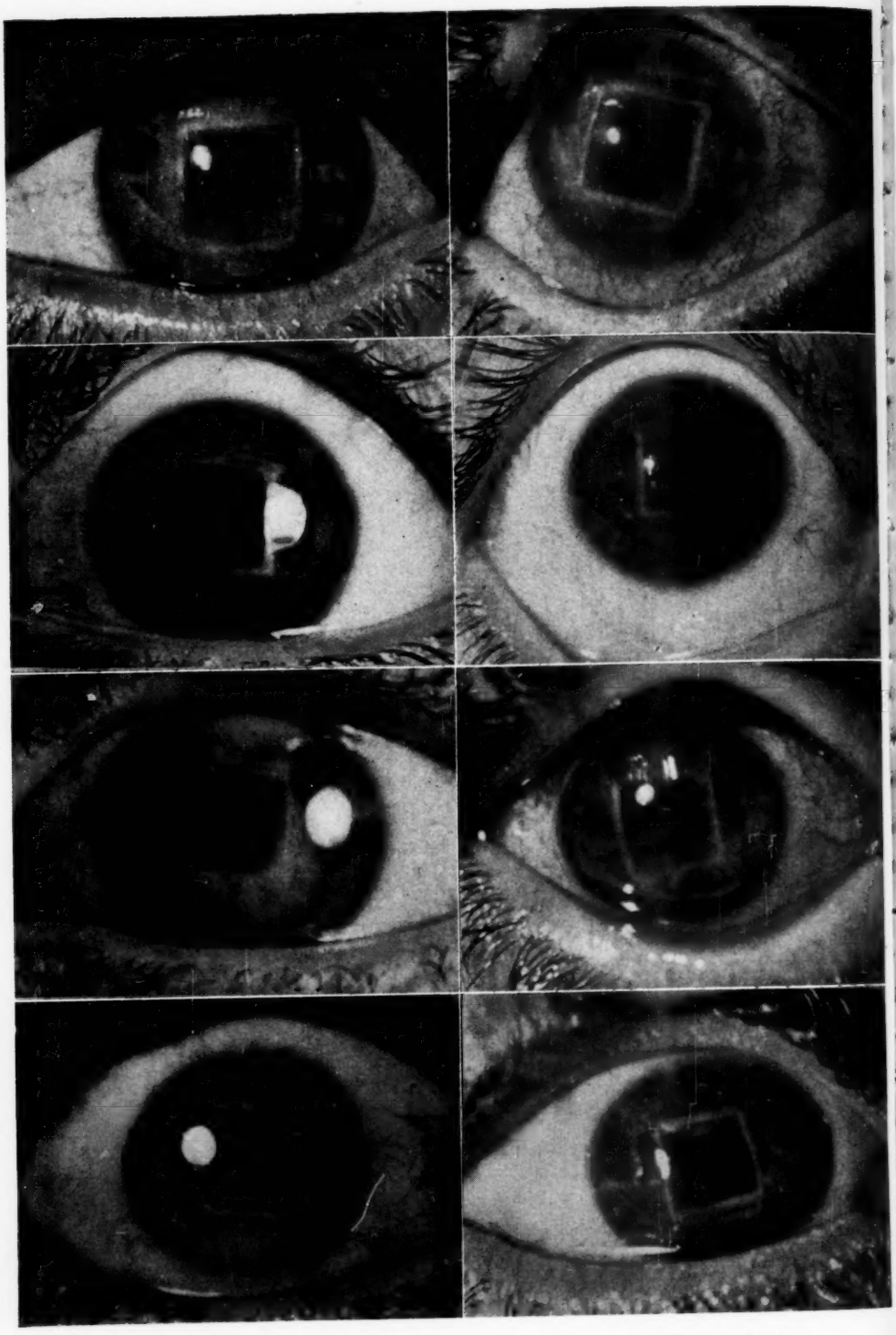

Fig. 7 (Castroviejo). Photographs of clear square corneal transplants.

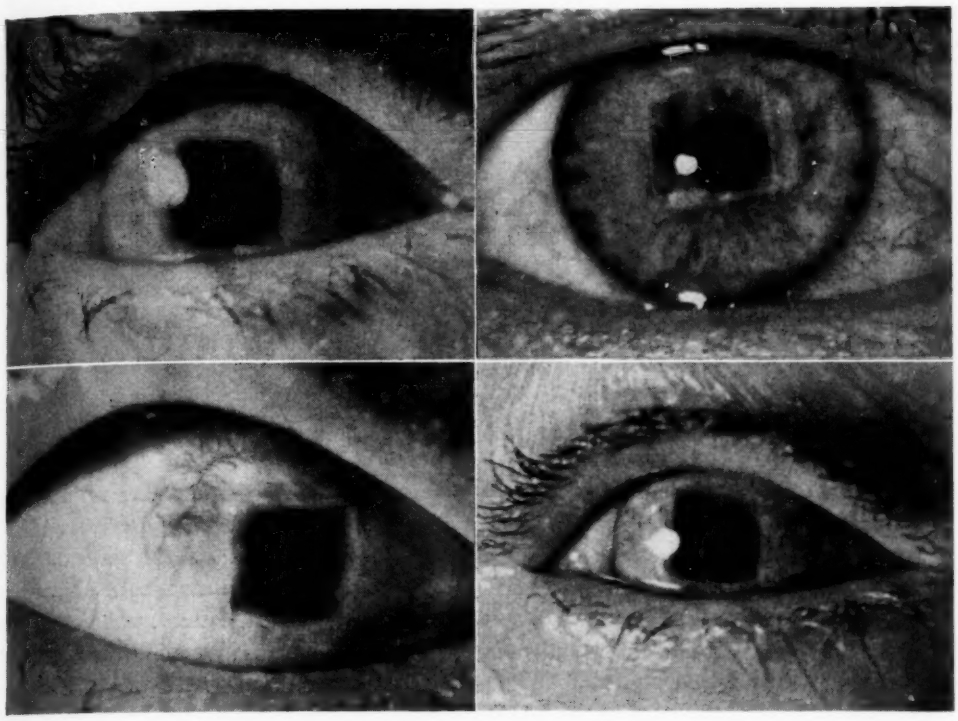

Fig. 7 continued (Castroviejo). Photographs of clear square corneal transplants.

Postoperative care. The patient is placed in bed decubitus supinus, in which position he is to remain for about 10 days. A gatch of about 25 degrees may be permitted to elevate the head and the back if he is uncomfortable, but care should be taken to keep the head motionless, preventing unnecessary efforts which might interfere with the proper healing of the graft. The first dressing is performed two days after the operation, and atropine is instilled to keep the pupil dilated to prevent anterior synechiae if the anterior chamber, once re-formed, should accidentally collapse. From then on, every two days the dressing is changed and atropine instilled. At the third dressing, six days after the operation, the suture is removed under local or general anesthesia, depending upon the coöperation of the patient. In some special cases, such as keratoconus, in which the cornea of the host surrounding the transplant is very thin and healing takes place more slowly, the sutures ought to be left in place for at least eight days. The night of the seventh day after the operation a dose of cascara is given to the patient, followed the next morning by a small dose of milk of magnesia and an oil enema, retained for one hour, which produce a soft evacuation without effort. On the tenth day, the other eye may be uncovered, and the patient may be allowed to get out of bed. By the fourteenth day the eye that has been operated on may also be uncovered. Atropine may have to be continued if the eye remains irritated and the pupil has a tendency to contract. As soon as all signs of inflammation have disappeared, atropine may be discontinued. In cases of keratoconus and other conditions with thin corneas, it is necessary to maintain a moderate pressure dressing for about

two weeks after the removal of the suture. Otherwise the transplant has a tendency to heal unevenly around the edges, and in some instances may protrude slightly, causing pronounced astigmatism or myopia. The patient is given a fluid diet for the first two days, semifluid during the following four days, and then gradually resumes a normal diet.

When the technique just described is used in favorable eyes, 90 percent or more of permanent transparencies of the graft with considerable improvement of vision may be expected (fig. 7). Statistics of 200 keratoplasties, classification and selection of cases will be discussed in another article.

ON THE HYPOFUNCTION OF THE LACRIMAL GLAND*

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Diminished lacrimal secretion is generally accepted as the cause of filamentous keratitis (Leber[1]) or keratitis sicca (Duke-Elder[2]). Sjögren,[3] calling it keratoconjunctivitis sicca, has found this disease and its lighter forms in a syndrome consisting of diminished secretion of the salivary glands, dryness of the oral, nasal, and laryngeal mucous membrane, arthritis, slight fever, anemia, lymphocytosis, and increased blood sedimentations. Melanowski[4] called attention to the insufficiency of lacrimal secretion in superficial keratitis, especially of the dendritic and neuroparalytic type, and further in 75 percent of corneal ulcers in trachoma.

In the last two years I have observed 18 patients whose complaints pointed to chronic conjunctivitis, but the findings did not give a satisfactory explanation. Complaints were: eyes get tired when reading by artificial light; feeling of heaviness in the eyes; they do not open freely in the morning without being stuck together, and when open there is a feeling of sand. Sometimes the patients mention burning and even dryness of the eye. They feel worse in dry, warm, dusty seasons. In some cases there are no findings at all, or just a very fine hyperemia of the bulbar conjunctiva. This may be less shiny, and, in more marked cases, when pulling the lid from the eyeball, there is more adherence between the bulbar and palpebral conjunctiva than is normal. Some patients have a small amount of dry matter in the inner angle in the morning. In only four cases were there very small round areas of the cornea which stained with fluorescein or with rose bengale; in five other cases fine epithelial edema was found. The patients are mostly pale, thin women in the sixth or seventh decade of life. Several of them had had an early menopause, spontaneous or due to ovarian disturbance or removal. Otherwise their general health was fairly good. Three of them had chronic arthritis, diet mixed, no hypovitaminosis. This must be mentioned because Cordes and Harrington[5] isolated a group of patients with chronic conjunctivitis and asthenopia, due to a hypovitaminosis, who had very similar complaints. They eat, as a rule, sufficient butter and carrots to escape suspicion of vitamin-A deficiency. Nearly all have artificial dentures. Their previous ocular treatment consisted of astringent drops, and they had been provided with a series of tinted glasses. In the years

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* From the Department of Ophthalmology, Northwestern University Medical School. Read before the Chicago Ophthalmological Society in March, 1940.

1937 and 1938, I saw 13 such cases out of 3000; and in the last 6 months 5 cases out of 1200 patients. Thus their ratio among eye patients runs to about 0.4 percent. Two typical cases are described.

Mrs. J. A. K., 46 years old, a housewife, was seen on November 13, 1939. For 10 years there had been an increasing dryness of the eyes, chiefly when she was reading or driving. There were tears, however, when she wept. Her ovaries had been removed because of a tumor 15 years previously. Her general health is otherwise good.

Examination revealed a net of small vessels in the bulbar conjunctiva; the slitlamp, a fine epithelial edema. Vision R. and L. E. was 20/13 with +0.25 D.sph. ⊂⊃ +0.50 D.cyl. ax. 90°. The Schirmer test was 0 mm. in 5 min.

Mrs. J. D. M., 70 years old, a housewife, was seen in November 28, 1939. She had had pain and a burning sensation in the eyes at times for six years. Climacterium at 42 years; no children. She had lost the last of her teeth seven years previously.

Examination showed the bulbar conjunctiva of both eyes, except the portion covered by the upper lid, to be moderately congested. The slitlamp showed no corneal changes. Vision R. and L.E. was 20/16 with +1.50 D.sph. ⊂⊃ +0.25 D. cyl. ax. 180°. Schirmer test was 3 mm. in 5 min.

Thus, the complaints are vague, not characteristic, and the findings are practically nil, or very minor under slitlamp observation. But there is one characteristic symptom they have in common, the low lacrimal secretion. The Schirmer test shows zero to 6-8 mm. in 5 minutes, whereas the lower limit of the normal is 15 mm. according to Schirmer.

What is pathologically low lacrimal secretion? The method used to determine the amount of tears produced by a certain, standard irritation is that of Schirmer.[6] Strips of blotting paper 35 mm. long and 5 mm. wide are used. At one end 5 mm. of the strip is bent, the corners of this piece cut off, and by aid of the bent piece it is hooked over the margin of the lower lid and allowed to remain there for 5 minutes. If the whole strip becomes moist within 5 minutes, this time is marked. If not, the portion that became wet is measured. The first 5 millimeters, that part of the strip that lies on the conjunctiva, is disregarded. According to Schirmer, everyone who has a lacrimation of less than 15 mm. in 5 minutes may be suspected of a paresis of the excitolacrimal fibers. But it should be noted that at the time when he described his method, in 1903, primary hypofunction of the lacrimal gland was not known. The lacrimal gland and its innervation can be considered as normal if the moistening amounts to more than 15 mm. in 5 minutes. In a paper on filamentary keratitis read before the American Ophthalmological Society in 1935, Beetham[7] stated that he "used this method on many patients with normal eyes, and on several occasions the measurement has been as low as 10 mm. A distance of less than 10 mm. in 5 minutes would signify, therefore, diminished lacrimal secretion."

Those who have a lacrimation of less than 15 mm. in 5 minutes are examined with a second method. The eye receives 3 drops of 4-percent cocaine at intervals of one minute. Reflex irritation of the lacrimal gland is carried out by introducing and rotating a camel's-hair brush high within the nose. Usually a strip of 30 mm. is moistened by tears, within two minutes, but a normal gland never produces less than 15 mm. The first method of Schirmer is quick, easy to apply, requires but the precisely shaped strip of blotting paper. His second method is too drastic to be used in general practice.

Observations made by these tests, however, enable us to offer some suggestions. Schirmer uses a strip of blotting paper, and Sjögren strips of red litmus paper. Samples of blotting paper may be very different, which would make a comparison of the results obtained by various investigators impossible. I compared several blotting papers and filter papers* as to the absorption of water and length of strip moistened by the same amount of water. For this purpose strips 5 mm. wide and 70-80 mm. long were suspended by their upper end. Near the lower end one drop of saline was applied and the length measured which became moistened in 5 minutes. It was further observed whether the drop of water was soaked up rapidly or whether there was a droplet of water at the lower end of the strip.

Common commercial blotting paper varies in different countries, papers that are too hard irritate the eye unnecessarily, those that are too soft and light adhere to the lid when wet. Papers with imperfect absorption had to be disregarded. Whatman no. 41 filter paper "double acid washed, very rapid, soft with open texture" proved to be the best among the papers tried. It is not hard, has a very fine velvety surface which adheres well to the tarsal conjunctiva, and has a good absorption capacity. We propose the use of strips made out of this paper for the performance of the lacrimation test. As

TABLE 1

RESULTS OF LACRIMAL-PRODUCTION TEST BY SCHIRMER'S FIRST METHOD

Age Group years	Entire Strip Moist Within				Amount of Strip Moistened Within 5 Minutes				Number of Patients in Age Group		
	2½ min.		5 min.		16–30 mm.		15 mm. or less				
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	
5–10	2	4	0	4	1	1			3	9	
	6		4		2		0		12		
11–20	3	7	2	5	8	2			13	14	
	10		7		10		0		27		
21–30	1	4	5	1	6	2	0	3	12	10	
	5		6		8		3		22		
31–40	3	1	3	4	3	2	1	6	10	13	
	4		7		5		7		23		
41–50	1	6	1	3	3	8	1	5	6	22	
	7		4		11		6		28		
51–60	0	3	0	3	4	7	4	10	8	23	
	3		3		11		14		31		
61–70			2	4	0	2	5	1	7	7	
	0		6		2		6		14		
71—	0		0	1	2	1	0	1	2	3	
			1		3		1		5		
Total	10	25	13	25	27	25	11	26	61	101	
	35		38		52		37		162		

* Commercial green blotting paper, Reeve Angel bibulous paper, Munktells filter papers OA, 100, O, OK, OB, 50/200, Agar-agar filter paper, E. A. Sargent pure white filter No. 500, Whatman Nos. 3, 4, 41.

Schirmer proposed, on one end 5 mm. has to be bent and the corners of this end were cut off. The bent end of the strip was placed under the lower lid, at the junction of the outer and middle third. This is important so that in all cases the same degree of irritation may be exerted.

As to the second method of Schirmer, other minute. Thus the strip is in place for two minutes. This second method is less precise than the first, for the depth of breath taken and the irritability of nasal mucous membrane differs a great deal in individuals.

It is rather conspicuous that the great majority of those suffering from the

TABLE 2

RESULTS OF LACRIMAL-PRODUCTION TEST BY NASAL IRRITATION

Age Group years	Entire Strip Moist Within 2 Minutes		Length of Strip Moistened in 2 Minutes						Total	
			21–30 mm.		11–20 mm.		0–10 mm.			
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
5–10	0	2	0	3	0	0	0	0	0	5
	2		3		0		0		5	
11–20	0	3	3	3	3	2	1	2	7	10
	3		6		5		3		17	
21–30	2	1	3	3	3	2	0	1	8	7
	3		6		5		1		15	
31–40	0	0	2	2	0	6	2	3	4	11
	0		4		6		5		15	
41–50	0	2	0	4	4	4	2	5	6	15
	2		4		8		7		21	
51–60	0	0	0	3	3	11	2	4	5	18
	0		3		14		6		23	
61–70	0	0	0	1	2	4	3	1	5	6
	0		1		6		4		11	
71—	0	0	0	1	1	1	0	1	1	3
	0		1		2		1		4	
Total	2	8	8	20	16	30	10	17	36	75
	10		28		46		27		111	

the use of a small brush to irritate the lacrimal gland through the nasal mucous membrane is too drastic to be used in practice. Instead of this, inhalation of ammonia can be used to irritate the nasal mucous membrane. The eye receives two drops of butyn at intervals of two minutes, after which the strip is hooked in and a watery solution of ammonia is given to inhale through the nose, repeated in one-half and in one minute. The reading is done after an interval of an-

above-mentioned disease, the main symptom of which is hypofunction of the lacrimal gland, are past middle age. Is there any relation between age and the production of tears? There are no such data known to us in the literature. Investigations were carried out in the eye department of the Northwestern University on 162 clinical patients who were not suffering from inflammatory eye diseases. Table 1 shows the results.

There is a decrease in the amount of

lacrimation with advancing age. In the first two decades, the majority of individuals (27 out of 39) moisten the strip within 5 minutes. There was not one person who moistened it less than 15 mm. In the third and fourth decades the two groups are about equal: 22 persons moistened the entire strip and 23 moistened 30 mm. or less in 5 minutes. In the fifth and sixth decades the corresponding numbers are 17 and 42, and in the seventh and eighth decades, 7 and 12. Thus the production of tears decreases with the age at least up to the sixth decade. Twenty-seven out of 78—that is, one third of the individuals older than 40 years—had a lacrimation of 15 mm. or less; which was considered as pathological by Schirmer.

What is the influence of sex on the production of tears? Women are relatively more numerous in the extreme groups. With a certain reservation—owing to the small number of cases—we can state that young women have a more active lacrimation than young men, and older women produce a lesser amount of tears than older men.

The second method, irritation of the nasal mucous membrane by ammonia has not been used in all cases. They are divided into four groups (table 2) according to the length of the strip moistened in two minutes. This method shows a shift with the age as well. The number of cases with 10 mm. and less—that is, the lowest group—increases with age; their number is about one-third of the cases beyond the fourth decade. Among 111 individuals of various ages, examined by both methods, 13 individuals had a definite low lacrimal secretion using both methods, all being over 40 years of age. Thus about 10 percent of the average clinical patients, chiefly cases of refractive errors, have a lacrimal secretion which has been considered as pathological. And about one third of individuals older than 40 years show this condition, without any complaint.

In view of such findings, what is the significance of the low lacrimal secretion in these cases? Reduced lacrimal secretion has been held responsible for filamentous keratitis and keratoconjunctivitis sicca.* On the other hand, low tear production is present in a high percentage of persons who have no complaint. It is obvious that there must be another factor beside the hypofunction of the lacrimal gland to produce these diseases. We do not know what this factor is. I would, however, point to a complication of cataract extraction which may throw light on this question. I have seen two cases, have found three more in a recent paper by Klauber,[8] and find it mentioned as a complication after cataract in de Schweinitz's textbook (Diseases of the eye, 1916); namely, filamentous keratitis which follows cataract extraction. The trophic disturbance due to the cataract wound is the factor in these cases besides the low lacrimal secretion found in my cases. Further predisposing factors may be lack of estrogen, for we find this disease in women past the menopause or deprived of ovaries; vitamin-A deficiency, because of its deleterious action on the lacrimal gland and on the corneal and conjunctival epithelium; and perhaps a change in the composition and viscosity of the tears.

What is the relation between the diseases caused by very low tear production, such as filamentous keratitis, keratoconjunctivitis sicca of Sjögren, and our cases? There is only a gradual difference. I consider my cases as the slightest clinical manifestation of the hypofunction of the lacrimal gland. The four cases which showed very small, round defects of the corneal epithelium when stained with

* As a partial symptom of a syndrome.

fluorescein can be considered as the slightest cases of keratoconjunctivitis sicca. The term filamentous keratitis should be reserved for cases in which there are actual fine threads on the cornea.

Thus in the most severe form, fine threads, adherent to the cornea, formed from epithelial cells are present; this is the classical picture of filamentous keratitis. In the slight form, there are small round epithelial defects, at times visible only when stained with rose bengale or fluorescein. For this picture the term keratoconjunctivitis sicca should be used. The slightest form of the hypofunction of lacrimal gland does not show any or but the slightest corneal and only slight conjunctival symptoms. There are subjective symptoms due to the relative dryness.

Summary

Attention is called to a certain group of patients, women in normal or artificial menopause, about 0.4 percent of my eye cases, who suffer from light sensitiveness and burning of the eye; they become easily tired when reading and show practically no clinical symptoms. Their common symptom is very low lacrimal production. We consider these cases to differ only in degree from those of keratoconjunctivitis sicca and filamentous keratitis. They are the mildest form of the clinical manifestations of lacrimal hypofunction.

Schirmer's method of checking the function of lacrimal gland by a strip of blotting paper has been standardized. It has been found that the lacrimal production decreases with the age. Above 40 years of age about one third of individuals have a lacrimal production that has been considered as pathologic by Schirmer, without offering any complaints because of the low secretion. Thus low secretion alone obviously does not always lead to filamentous keratitis. There are also other factors in play. Such factors might be, for example, disturbance of the trophic nerves of the cornea, ovarian hypofunction, vitamin-A deficiency, and a qualitative change in the tears.

Old National Bank Building.

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THE EYEGROUNDS OF PATIENTS WITH FUNCTIONAL PSYCHOSES GIVEN INSULIN-SHOCK THERAPY

Review of the literature*

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A wide variety of reasons led to undertaking the study to be described. These reasons and the findings, it is hoped, will prove of value to both the psychiatrist and ophthalmologist. The use of insulin in the armamentarium of the psychiatrist, with its occasional damaging physical consequences to the central nervous system, makes the eye an object of interest. Since the retina is not only derived from the same germ-layer as the brain but also possesses a similar histologic structure, with cells analogous to those injured in the brain, it should be the logical organ to observe. The uncertainty of our knowledge of what occurs in brains of patients surviving insulin-comas and convulsions makes a fundus study desirable, for it may furnish a clue to what transpires in the organ from which the eye develops.

When large doses of a drug are administered, it is customary to investigate organs likely to be affected. Thus, treatment with arsenicals demands study of vital organs, including the eye, in order to forestall disturbance of their intrinsic function and structure. This serves as an additional incentive for following the fundus during insulin therapy in search of possible changes. At the same time we may reason that as the function of the liver is studied to prevent overzealous treatment with dangerous drugs, so might the fundus be observed as a weathervane, indicating serious consequences to come. In addition, the retina might act not only as a harbinger of mishap, but also as a source of prognostic criteria.

Not a few ophthalmologists think that insulin used therapeutically contributes to the diabetic fundus picture. Thus, Poyales[1] says that diabetic lesions of the fundus grow worse and tend toward a hemorrhagic type when insulin treatment is instituted. Some think, too, that insulin plays a part in the production of retinal detachment. A therapeutic procedure in which thousands of units of insulin are administered in a short time could enlighten us on these interesting ophthalmological problems. Finally, from the point of view of pure scientific curiosity, which leads to the accumulation of knowledge, we may consider it valuable to observe and report on the fundi of psychotic patients given insulin-shock treatment.

Review of the literature

The fundus of mental patients. As long ago as 1856, the fundus of the insane was an object of study. In that year Ludwig[2] posed the question: "Can we judge the brain by an examination of the retina of mental patients?" Though he could not answer he admonished the psychiatrist to study the eye seriously. Since then not a few examinations of fundi have been made with much difference of opinion as to findings. Wollenberg,[3] in a study of 847 men and 956 women with functional psychoses found 1.2 percent of the former and 0.72 percent of the latter to have congenital anomalies, including defective papillae, myelinated nerve sheaths and vessel anomalies. Although other psy-

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choses were studied too, no definite diagnostic criteria were discovered in the 6,400 patients he examined, and the cases seen were not well classified into groups. Uhthoff[4] in 1915 reported that in schizophrenia there is no characteristic fundus picture, disagreeing rather sharply with Tyson and Clark.[5] The latter two studied 109 cases of dementia praecox and divided the fundus pictures into three groups, as follows:

(1) Congestion of discs; hyperemia and edema; dilated, dark-colored veins; slightly contracted arteries and blurring of the edges of the discs. These changes constitute, according to them, a low-grade perineuritis of the optic nerve.

(2) Congestion of the nasal side with temporal pallor of the discs, dilated veins, and contracted arteries.

(3) Pallor of the discs, dilated veins, and contracted arteries. These changes constitute anemia and partial atrophy of the optic nerve.

These investigators declare that more marked changes are found in the more rapidly deteriorating types of schizophrenia. Further, they say the optic-nerve lesions described are in accord with "our best knowledge of the pathologic anatomy of dementia praecox." They offer these "eye-syndromes" to be of diagnostic and prognostic value.

The preponderance of opinions controverts their findings and conclusions. Their optimism seems to be as well founded as their presupposition that schizophrenia is an autotoxic disease that principally injures vessels. It is likely that their findings were influenced by their original thesis as to schizophrenia's "etiology." Wintersteiner[6] denies that there are vascular changes in the fundi of schizophrenics, but in his study of 120 cases of dementia praecox reports some changes in small percentages. Though he does not indicate clearly whether they are chance complications, one gathers that he agrees with Uhthoff[4] rather than with Tyson and Clark.[5]

Kaminskaja-Pavlowa and Goldblatt[7] after studying 143 purely functional cases, agree with Uhthoff,[4] and add that the fundus neither parallels the severity of the mental illness nor progresses with the advance of the insanity. Holmes[8] found 20 percent of 2,000 psychotic patients to have demonstrable fundus pathology related to the etiologic factors responsible for their psychosis. However, these had organic psychoses or organic diseases associated with the functional insanity. The remaining 1,600 cases were not discussed, but it may be inferred that they showed no pathology. Unfortunately, they were not grouped.

Though the literature gives some conflicting evidence, the concensus of opinion seems to be that the functional psychoses do not present characteristic eyegrounds. Any changes found cannot logically be attributed to the illness. They are incidental rather than part and parcel of the larger entity. Certain it is that they do not progress with the course of the mental illness.

The Effects of Insulin

Pathological and physiological considerations. It is generally conceded from experimental work and study of human autopsy material that prolonged insulin-coma produces cerebral damage, although the extent and mechanism are a matter of debate. Weil, Liebert, and Heilbrun[9] find that the brains of rabbits dying in hypoglycemic convulsion show diffuse severe damage of the ganglion cells, while those allowed to survive show less marked damage over a wide area. Their rabbits remained free of changes if 70 or less units were injected over a period of two months, whereas those receiving 200 to 400 units had severe changes. Reed and

Dancey,[10] and Accornero[11] agree that the cerebral damage is diffuse in animals and humans dying in convulsion. The former, however, think that if glucose is given soon enough, there is no permanent change, whereas Accornero says that animals killed 2 to 15 days after they had received 30 insulin shocks show less diffuse damage and more localized areas of necrosis related to circulatory disturbances. Ferraro and Jervis[12] and also Malamud and Grosh[13] stress the diffuse nature of the cerebral damage and point out that the focal changes are merely local accentuations of the generalized process. Roisin[14] believes that the "toxic-metabolic process" caused by hypoglycemia produces diffuse cerebral changes, but with Ferraro,[12] believes the focal changes to be due to vascular disturbances, including increased permeability and vessel-wall changes.

There exist differences of opinion as to the physiological mechanism responsible for cerebral pathology. It is principally thought, though, that in the presence of hypoglycemia the nerve cells cannot utilize oxygen, and therefore degenerate. Weil[9] says the cause is an intracellular anoxemia due to the presence of large doses of insulin, not a vascular disturbance. Dameshek *et al.*,[15] Gellhorn,[16] and Wortis[17] agree that a decreased oxidative process plays an essential role in the production of the clinical and neurological symptoms. Malamud and Grosh[13] interpret the degeneration of the brain as due to a direct toxic effect of insulin on the parenchyma. Ferraro and Jervis[12] lend him a measure of support, but go one step further, and with Grayzel[18] and Accornero[11] think that a vascular mechanism is important. The latter two stress the importance of the convulsion itself. Grayzel[18] thinks minimal or no changes occur in animals unless the convulsion is severe and prolonged enough to produce anoxemia due to circulatory disturbance. Accornero[11] says cerebral changes are more severe if convulsions occur.

Appearance of Fundus and Histopathology of the Eye

Ciotola[19] reports the fundus of patients in coma due to hypoglycemia to be paler than normal. This he attributes to a decreased flow of blood to the choroidal plexus. Cozzoli[20] and Accardi[21] say insulin produces hyperemia of the retina, while Wolf and de Jongh[22] report negative findings in hypoglycemic rabbits.

Microscopic study of the eyes of rabbits dying in hypoglycemic convulsions has been reported in only one paper discoverable in the literature. Mamola[23] finds that there is nothing of note except small hemorrhagic foci near the ciliary body. These he attributes to the convulsions rather than to the insulin coma.

Intraocular Tension

Though hypoglycemia may effect the seeing apparatus in various ways, producing visual disturbances and pupillary changes (Rynearson[24]), the preponderance of study has been on intraocular tension. That decreased intraocular tension frequently exists in diabetic coma is generally accepted, but Patek's[25] statement that "hypotonia bulbi is not found in comas other than those of diabetic origin" finds a different reception. Weichmann[26] says that humans show a reduced intraocular tension in insulin hypoglycemia. Ciotola,[19] studying 11 insulin-treated psychotics, found generally a decrease in tension down to 12 mm. Hg. He never found a hypertonia bulbi. Vestergaard[27] finds that both normal and diabetic individuals show a fall in intraocular tension of 17.5 percent beginning 10 to 20 minutes after insulin injection.

Working with rabbits, Mamola[23] and

Wolf and DeJongh[22] find that if sufficient insulin is given occular tension is decreased. However, the former says that the sugar content of the blood is not of importance and that the tension remains lowered for 24 hours, whereas the latter report that glucose given soon enough after convulsions will usually prevent hypotonia bulbi. Interestingly enough Wolf and DeJongh[22] say that the tension is lowered only after a convulsion, and that strychnine, camphor, and picrotoxin in convulsing doses also produce decreased ocular tension. Raiha and Gronlund[28] report a decreased intraocular tension in rabbits followed by an increase of a transitory nature. Gray[29] says that at the beginning of "insulin coma" there is little change in the intraocular tension, but in repeated reactions—for example, occurring every 24 hours—there is a gradual "hardening of the eyes."

Richter,[30] Bistis,[31] and Accardi[21] report that insulin in sufficient doses will raise the intraocular tension. Richter[30] states that the effect endures six hours and the rise may reach 38 mm. Hg. Cossa *et al*[32] find that in hypoglycemic coma the diastolic pressure of the retinal artery doubles.

The mechanism whereby this fall in tension occurs is explained in various ways. Weichmann[26] and Ciotola[19] think that concentration of the blood due to sweating and consequent increased colloidal osmotic pressure is the chief reason for lowered tension. Ciotola[19] gives as a minor reason the accumulation of substances with capillary toxicity. This seems to gain confirmatory support from Wolf and DeJongh's[22] finding that serum from convulsed animals produces decreased intraocular tension when injected intravenously into other rabbits or dogs. They claim to have separated out of it the responsible agent. Mamola[23] thinks that ocular tension is lower because of a hypotensive principle present in insulin, which operates regardless of the administration of glucose.

Insulin and retinal detachment

In the past 10 years there have been reported two cases of retinal detachment supposedly caused by insulin administration. Alperin[33] describes the case of a diabetic who, while being treated with relatively small doses of insulin, suddenly became blind after an injection. Examination revealed detachment about the macula. Alperin attributes this to disturbed electrolytic and osmotic processes in the blood and ocular fluids which result in fluid being thrown into the subretinal space from the choroidal plexus of vessels. McBean[34] reports blindness due to retinal detachment and secondary iridocyclitis in a 35-year-old hyperopic woman who received 10 units of insulin every day for two months to improve her appetite. He ascribes her blindness to the insulin.

Technique of study

Because the cases observed were not under our immediate care, the investigation precluded examination of fundi while patients were in coma. However, another course was open to us. From their place of residence patients were brought to the hospital clinic where they could be seen at our leisure. Because they received treatment every week-day morning, we saw them Friday afternoons or Saturday mornings. As a rule, each subject was seen every two weeks, and in some cases every third week. Inasmuch as we were primarily interested in permanent changes in the fundus that might occur, this course seemed satisfactory as well as practical.

Each time a patient was seen his blood pressure was recorded, and, when it could be obtained, a urine sample was exam-

ined for sugar and albumen. In all cases, at least one sample of urine was thoroughly examined, but in most several were analyzed, so that an accurate urinary status was determined. Wide dilatation of the pupil was obtained at every visit with the use of 2-percent homatropine in order to facilitate a thorough search of the fundus each time. After the examination, 1-percent pilocarpine was instilled in the eye. The number of times each patient was seen varied. This was so because some were paroled immediately after completion of therapy and some were at times too uncoöperative for examination. In addition, at the time the work was undertaken we started to see patients who had just completed treatment. Generally, though, patients went through the procedure outlined about six times. This decreased greatly the possibility of error.

Of the 35 patients so studied, 21 were seen once before treatment was begun. These were then seen several times during the course of treatment, and for a period afterward ranging from one day to 10 weeks. In all, they were seen between 4 and 11 times. The five seen only once, one day after therapy, were not seen longer because they were immediately paroled. When patients stayed longer they were followed for 8 to 10 weeks after completion of the insulin course, as we had planned. Fourteen of our patients were first observed after treatment was discontinued. These were seen from two to eight times in all and were followed for from 1 to 16 weeks. One patient was followed the 16 weeks and seen 8 times because of an interesting fundus finding to be described.

These 35 patients were treated for 6 to 12 weeks, and they ranged from 20 to 55 years in age. The number of individual treatments with insulin varied from 27 to 58, the lowest total dosage being 840 units and the highest 6,165 units. The minimum total hypoglycemic hours a patient endured was 113, whereas the maximum was 254. In her entire course of treatment, one patient became semicomatose only once while another had 40 real comas. Insulin convulsions varied from none to 11 in single cases. Five of the patients received metrazol in addition to insulin therapy.

Treatment in all the cases was terminated because the administrator deemed it sufficient in amount. It resulted in 10 considered much improved; 3 improved; and 22 unimproved. Thirty-one of the cases were of the dementia praecox group, three manic depressive, and one psychoneurotic. All had normal urinary findings, and the blood pressures ranged from 90/64 to 150/100, the great majority being within normal limits.

The possibility that a fundus change might show itself many months after treatment had been discontinued, induced us to examine more patients. For this reason, we studied 35 taken at random whose insulin injections had terminated 5 to 34 months previously. These had remained at the hospital, and were available. The technique of their examination was the same as in the case of the others, but each was seen only once to determine the status of the fundus.

These latter patients ranged in age from 19 to 42 years. The shortest period of treatment was 5 weeks for one patient and the longest 19 weeks, the number of individual treatments varying between 22 and 89. The lowest total dosage given any one patient was 745 units, and the highest 11,125 units. The minimum total hypoglycemic hours a patient endured was 89, whereas the maximum was 404. One patient became comatose only twice while another went into coma 51 times. Insulin convulsions varied from none to seven in single cases.

In most cases, treatment in the second group was terminated because the administrator deemed it sufficient in amount. In two instances acute illnesses ended the therapy. The treatment resulted in 26 remaining unimproved, 5 improved, and 4 much improved. Thirty-four of the patients had been classified in the dementia praecox group, and as to the thirty-fifth, opinion was divided between schizophrenia and postencephalitic psychosis. All had normal urinary findings, and the blood pressures ranged from 100/60 to 160/110, the great majority being within normal limits. One received metrazol as well as insulin therapy.

Findings

Of the first group of 35 patients seen before, during, and after treatment, 31 had fundi essentially within normal limits. In two fundus changes had been found before treatment was started; these did not progress during the therapy. One of these two patients was 55 years old and had changes characteristic of moderate arteriosclerosis. The other was a 35-year-old woman who had an old chorioretinal degenerative process just temporal and superior to the macula of the right eye. According to relatives, "her eyes were always weak," and on admission her vision was L. 10/10, R. 10/40. Ten weeks after treatment her vision was the same. The thirty-fourth case was of a 23-year-old female who showed bilateral temporal pallor of the discs seven weeks after treatment was completed. The last case of this group was of a 22-year-old girl first seen immediately after completion of seven weeks of insulin therapy. At this visit, an extensive, healed chorioretinal degeneration at the periphery of the fundus of the left eye was found. She was then seen 8 times in the course of 16 weeks, without any change in the lesion being detected. Anamnesis disclosed that she had been in an automobile accident two years before, suffering a concussion with accompanying visual disturbance of this eye.

In the second group, 30 of the 35 patients had essentially normal fundi. A 24-year-old man, who had had eight weeks of treatment with two convulsions, showed in the left eye, after eight months of treatment, a disc paler and sharper than the right. A 42-year-old woman had fundi essentially negative, except for a slight degree of arterial spasm when seen 31 months after her treatment. Another woman, 39 years of age, showed a high degree of myopia and a small temporal crescent of the fundus of the left eye, when seen 26 months after treatment. A 36-year-old man, who had been treated for seven weeks, was seen 22 months after therapy. The fundus of his right eye had a pinhead-sized, clearly defined pigmented spot just nasal to the disc. The surrounding retina was normal, as was the rest of his eyegrounds. A 33-year-old female, seen 29 months after treatment, had similar findings. In the fundus of the right eye there were two such spots, and in that of the left only one. These were along the course of arteries.

In the past nine months it has been our good fortune to see two cases of prolonged coma. Both had been diagnosed dementia praecox, paranoid. The first occurred in a 46-year-old man. On the third day of his treatment he was given 35 units of insulin and went into a coma that lasted 36 hours. During this period examinations were negative, except for vascular changes attributable to his age and elevated blood pressure. Treatment was discontinued. A month later his fundi showed no essential change. He developed pulmonary tuberculosis. When seen nine months later, his fundi showed no further changes.

The second case of prolonged coma

occurred in a 40-year-old woman who died after remaining unconscious for 10 days. She was examined several times a day but showed no fundus changes, except some venous engorgement in the last two days of her life. She had been treated with insulin for eight weeks and had been receiving 125 units daily for several weeks before her final coma. On several occasions intravenous glucose, as well as intranasal sugar solution, had to be given to interrupt coma. She had 25 comas but no convulsions, and received 2,500 units of insulin in all.

Summary

Though there is some disagreement, the consensus of opinion is that the functional psychoses present neither characteristic eyegrounds nor fundus changes that progress with the advance of the mental illness. Positive findings are associated with other pathology of an organic nature, but not of greater incidence than in normal people. Given no generalized physical process nor local ocular disease, the appearance of the fundi in psychotic individuals will be as in mentally normal people.

It is generally conceded that insulin, given in doses sufficient to cause prolonged hypoglycemic coma and convulsions in experimental animals, will produce diffuse cerebral damage with accentuated localized areas of destruction. In humans, prolonged, fatal coma produces very much the same result. The similarities between the retina and the brain make the accessible fundus a desirable region to study.

The literature differs regarding the appearance of the fundus during insulin coma, reporting both hyperemia and anemia of it. One histologic study of the eyes of a rabbit dying in hypoglycemic convulsions shows minor hemorrhagic foci near the ciliary body. The intraocular tension during insulin coma has been reported by some to be decreased, and by others to be increased. Ophthalmologists declare diabetic fundus-changes to be aggravated by insulin and two ascribe retinal detachments to insulin administration.

No report of the human eyegrounds after insulin-shock therapy has been made. This study is meant to fill that void. Two groups of 35 cases each were studied with the ophthalmoscope. The first group was seen principally just before therapy, as well as during, and for a period up to 16 weeks after treatment. This series was studied for immediate changes. The patients of the second group had been treated 5 to 34 months before being seen. This series was studied for possible late changes.

Conclusions

In an ophthalmoscopic study of the eyegrounds of 70 patients with functional psychosis who received insulin-shock therapy, no typical changes were found that could be attributed to the treatment. Retinal detachment occurred in none of the cases.

There does not seem to be a characteristic appearance of fundi of patients with functional psychosis.

The duration of a functional psychosis does not influence the appearance of the fundus.

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THE PHARMACOLOGICAL BEHAVIOR OF THE INTRAOCULAR MUSCLES*

III. "CHOLINERGIC" BEHAVIOR OF THE DILATOR IRIDIS

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PURPOSE OF THE EXPERIMENTS

In the terminology of current thought regarding the workings of the autonomic nervous system, the dilator iridis is an adrenergic effector—that is, its proper stimulus is an adrenalinelike substance, "sympathin," secreted as a neurohumor by the ends of active sympathetic fibers. It is not to be expected that any such effector will be set in action by the "opposite" neurohumor acetylcholine or its pharmacological mimics; but Velhagen (1933) has reported a responsivity of the dilator to acetylcholine.

Velhagen used rather large dosages, up to 1:4,000, and assumed that their effect was an immediate one upon the muscle. We have been interested to pursue this matter further and to inquire whether, if the dilator does respond to acetylcholine and the mechanism of such stimulation is essentially the same as in the (cholinergic) sphincter, it might not be possible to increase the effect by sensitization with eserine. Furthermore, we have felt that additional hints as to the specificity of cholinergic and adrenergic phenomena in the iris muscles might be gained by involving adrenaline and atropine in these experiments.

We have also been intrigued by the interesting findings of Mlle. Lánczos (1939) and have so organized our own experiments as to yield parallel information. She has reported that in *Rana esculenta,* following unilateral cervical sympathetic ganglionectomy, a marked dilation of the homolateral pupil can be produced with acetylcholine. Since a paradoxical dilation to acetylcholine also occurs occasionally in the cat, we have sought to determine whether a denervated mammalian eye is at any advantage in making a dilator reaction to cholinergic drugs such as eserine and acetylcholine.

To forestall any possible misconception of our point of view in making these studies, we wish to emphasize that, in our opinion, one has no right to assume respective cholinergic or adrenergic innervations in instances in which particular pharmacological reactions form the sole category of evidence. We prefer to consider that if sensitization between cholinergic drugs occurs in the dilator as well as in the sphincter, such a parallelism indicates the absence of any specific cholinergic receptor from both muscles rather than its presence "also" in the dilator.

NEUROLOGICAL STATUS OF THE MATERIAL

In the iris of the albino rabbit there is a nucleated Remak net near the anterior surface, a second net in the region of the sphincter, a third next the posterior surface, and two additional systems associated with the blood vessels. Ganglion cells are also present (Kirpitchowa-Leontowitch, 1911). The presence of motor plexi associated with the sphincter and dilator has been confirmed by Pollock (1914), who found that they persist after the disconnection of the iris from the central nervous system by the removal of the ciliary or superior cervical ganglion.

Two out of five rabbits survived the operation of left cervical sympathetic

* From the Department of Ophthalmology, College of Medicine, Wayne University. Read in substance before the Association for Research in Ophthalmology, in New York, June 11, 1940.

TABLE 1

DILATOR RESPONSIVITY TO ACETYLCHOLINE + ESERINE

Eye	Strip	Expt. (II was after wash)	Drugs, as applied*	Amplitude of Contraction, scale units	
				To First Drug	Total, to Both Drugs
Left (denervated side)	1	I	Eserine, then Acetylcholine	0.15	1.00
		II	Acetylcholine, then Eserine	0.20	0.55
	3	I	Es., then Ac.	0.00	0.35
		II	Ac., then Es.,	0.15	0.55
	4	I	Es., then Ac.	0.05	1.25
		II	Ac., then Es.,	0.55	1.10
	6	I	Ac., then Es.	0.60	1.35
		II	Es., then Ac.	0.10	0.85
	8	I	Ac., then Es.	0.00	0.20
		II	Es., then Ac.	0.00	0.40
Right	5	I	Es., then Ac.	0.00	0.70
		II	Ac., then Es.	0.15	0.35
	7	I	Ac., then Es.	0.25	0.40
		II	Es., then Ac.	0.00	0.35

* Concentrations 1:50,000 except on strip 8, where they were 1:200,000.

TABLE 1A

Eye	Strip	Drugs, as applied	Amplitude of Contraction, scale units	
			To First Drug	Total, to Both Drugs
Right	9	Eserine, then Acetylcholine	0.05	0.45
	12	Acetylcholine, then Eserine	0.00	0.15
Left	10	Es., then Ac.	0.00	0.55
	11	Ac., then Es.	0.15	0.40

ganglionectomy.* Sixteen and 18 days, respectively, after operation the animals were killed and, from both irides of each, dilator strips were prepared as needed for the various series of experiments. The methods of preparation, stimulation, and recording were those described previously (Sachs and Heath, 1940a). In order to eliminate the effect of varying post-mortem durations, these were kept balanced by testing homolateral and contralateral strips alternately on any one day. The numbers assigned to the strips in the tables refer to the actual chronological order in which they were used.

* We wish to acknowledge our appreciation of the invaluable assistance of Dr. H. M. Weaver in the performance of the operations.

RESPONSIVITY TO ACETYLCHOLINE AND ESERINE

We obtained contractions of the dilator to acetylcholine in dosages far smaller than Velhagen's—ranging from 1:50,000 down to 1:2,000,000; and some reactivity to 1:50,000 eserine was noted. The effect

of the combination of acetylcholine and eserine, and of their order of application, was tested as follows: With the dosages usually 1:50,000, and with the load always 20 mg., each strip was first stimulated with one drug, then the other was added. After washing the strip, a second experiment was made with the drugs in reverse order. In the first experiments on the various strips, one drug was given first in some cases, the other drug in other instances. The results are shown in table 1.

TABLE 2

EFFECT OF DENERVATION UPON SENSITIZED DILATOR CONTRACTIONS

Concentration of each drug:		Day	Strip	Average Amplitude of Sensitized Contractions, scale units	
				Left-eye Strips (denervated)	Right-eye Strips (controls)
1:50,000		1st	1	.775	.050
			2		
			3	.450	
		2d	4	1.175	.525
			5		
			6	1.100	
			7		.375
1:200,000		3d	8	.300	.450
			9		
			10	.550	
		4th	11	.400	.150
			12		
Averages				*.678*	*.310*

Four additional experiments were made without washing and retesting, with 20-mg. loads and with drug concentrations 1:200,000. Two right-eye and two left-eye strips are tabulated in table 1A.

The data in tables 1 and 1A reveal that the effect of the combined drugs always exceeds that of either drug alone. The single actions of both drugs on a given strip are brought out by the two-step procedure used on seven strips. The combined effect exceeds the total of these single actions, which would thus exclude mere summation even if no relaxation took place after the contraction to the first drug applied.

The combined effect is also greater than the larger of the two single effects in each strip, showing that true sensitization is taking place and that this is of the augmentative type, just as with the action of these same two drugs upon the sphincter as reported previously (Sachs and Heath, 1940b). Even when one drug or the other (strips 6 and 7) or both (strip 5) produced no contraction singly, their combination was still effective.

Again, the paired experiments shown in table 1 demonstrate that neither order of application of the drugs is superior to the other. Eserine-acetylcholine evoked the higher amplitude in four cases, acetylcholine-eserine in three. Augmentative sensitization occurred in both denervated strips and those from the normal side, a situation which deserves the special analysis which follows.

EFFECT OF DENERVATION

In table 2, the data in tables 1 and 1A have been rearranged to bring out the effect of denervation.

It is clear that the performances of preparations from the denervated side exceed those of the controls contemporary with them as to post-mortem duration. Their average performance is more than double that of the "normal" strips.

For purposes of rough comparison, we tested three denervated and two control strips (alternating the categories) with adrenaline in concentrations as low as 1:200,000,000. Here again the denervated material exhibited the higher sensitivity. Thus it can be stated that sensitization *ex* denervation has been localized in as limited a field as that of an excised strip of iris.

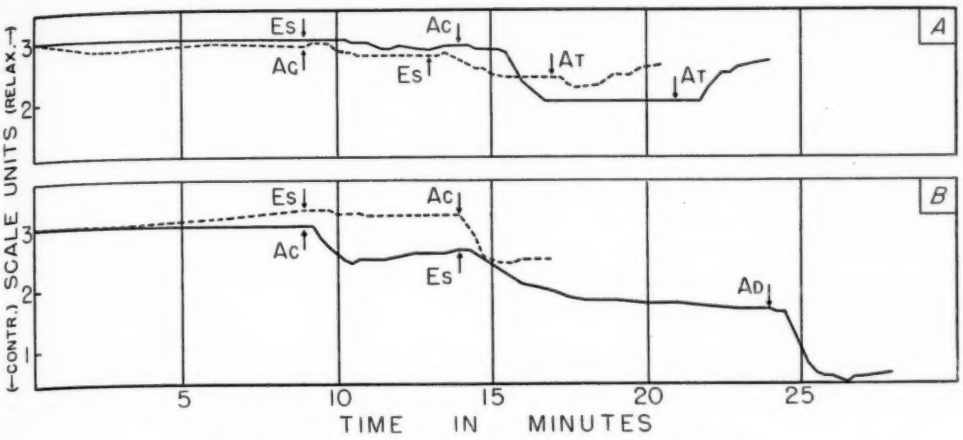

Fig. 1 (Sachs and Heath). Explanation in text, p. 36.

Responsivity to atropine

Our confirmation and exploration of cholinergic behavior in the supposedly purely adrenergic dilator suggested a test for another "cholinergic" property—namely, an antagonism of atropine. The results were quite in keeping with our tentative prediction: In seven experiments, the cholinergically contracted dilator strip invariably relaxed under 1:50,000 atropine sulfate. A sample experiment (on strip 1) is shown in graph *A* of figure 1.

In the first test (solid tracing) eserine was applied, then acetylcholine. A marked contraction occurred which was held steadily. Application of atropine now produced definite relaxation. After washing, the cholinergic drugs were again applied, in reverse order, and produced a contraction. After stabilization, atropine again caused relaxation after a brief and slight contraction.

We had an opportunity to make sure that in this situation the effect of atropine is not merely an abolition of the tonus of the muscle: A particular preparation, which had not yet been subjected to any drugs, was observed to be undergoing an unusually strong spontaneous contraction. Atropine (1:40,000) was promptly applied, but there was not the slightest decrease of the contracture. Thus, in the dilator at least, there is no "direct muscle action" of atropine. Whether atropine will or will not relax the contracted dilator depends upon what caused the contraction in the first place.

Intersynergy of adrenergic and cholinergic drugs

A logical final phenomenon to look for was a synergic interaction of cholinergic and adrenergic drugs on the dilator. On both a normal and a denervated strip, contracted by combined acetylcholine and eserine, the addition of 1:1,000,000 adrenaline did produce a further contraction. One of these performances is shown by the solid tracing in graph *B*, figure 1. While this strip (no. 6) was maintaining its sensitized contraction to the cholinergic drugs, the administration of adrenaline was promptly followed by an additional contraction of considerable amplitude.

Discussion

A fundamental question is whether the theory of the cholinesterase-destroying property of eserine, which accounts best for the sensitization of the sphincter to acetylcholine by eserine, can explain the

action of these drugs upon the dilator. Cholinesterase is present, of course, in the dilator preparation, and eserine naturally acts upon it wherever it may be. Any responsivity of the dilator to acetylcholine, however slight, will thereby be aided. On comparing the shape of the dilator contraction to acetylcholine (graph *A*, solid tracing) with that to adrenaline, or to cocaine and adrenaline, and the shape of sphincter contractions to acetylcholine or/and eserine (Sachs and Heath, 1940a, 1940b) we see that:

1. The shape of the dilator contraction is the same under the drive of both cholinergic and adrenergic drugs. There are no specific "drug" types of contraction—only a *dilator* type.

2. The dilator does not respond to eserine-acetylcholine with a "twitch," as does the sphincter, but contracts true to type.

3. The behavior of the dilator toward the cholinergic drugs is not affected by the order in which they are applied, as is that of the sphincter. Instead, the dilator behaves as it does under the cocaine-adrenaline combination.

We have suggested, *loc. cit.*, that the absence of a "twitch" response of the sphincter when eserine follows, instead of preceding acetylcholine, is evidence for a dependence of the twitch upon a steep gradient of acetylcholine concentration entering the muscle cell. The reversibility of drug application in the case of the dilator does not necessitate or permit such an idea. It would seem that the sphincter is *able* to make a special response to a gradient as such, while the dilator is not—it reacts to the analogous cholinergic stimulation just as it does to its physiological stimulus, adrenaline.

The eserine-acetylcholine combination and adrenaline apparently play upon the same instrument in the dilator, which makes no use of the steepness of a concentration-gradient in its responses either to cocaine and adrenaline or to acetylcholine and eserine, no matter what the order of application of either pair. The dilator seems to be incapable of such high-speed responses as the sphincter. One can readily understand this, from a biological point of view, for the pupil need never open rapidly (since the retina becomes dark-adapted so slowly) while in both rabbit and man it does need to be able to close quickly to prevent dazzlement. Even if the two pupil movements were carried out at equal speeds (in terms of diametral change) the sphincter, being circumferential, would still need to contract "pi" times as fast as the radially oriented dilator in order to affect the pupil diameter at the same rate.

The invariability of the character of the dilator response, even under cholinergic drugs, makes the presence of any specific cholinergic receptor substance most unlikely. Furthermore, the dilator responds to atropine, which certainly operates without a cholinergic receptor (Heath and Sachs, 1940). Then, too, the phenomenon of intersynergy between cholinergic and adrenergic drugs in the dilator helps to reshape our conception of drug specificity so far as the iris muscles, at least, are concerned:

The effector unit, the muscle cell itself, is neither adrenergic nor cholinergic but quite unspecialized, reacting to multifarious stimuli. Many of these are chemical and some of them—adrenaline, acetylcholine, ions, and so on—circulate in the body fluids. Promiscuous reactions to any but the "intended" stimuli *could* have been avoided by evolving differences in threshold to the various stimuli, with most of these thresholds very high. Or, *apparent* differential specific reactivity of the two contractile systems could depend upon the production, in proximity to them, of chemical agents which, though only two among many to which the muscles can

respond, are specific for their respective neurological sources and command the effectors by virtue of their proximity.

This, indeed, seems to be the situation. Thus the dilator normally reacts to adrenaline not because it has or is an adrenergic receptor, but because the specific neurohumoral agent to which it is most completely exposed happens to be the sympathin secreted by the termini of its sympathetic innervation. To this purely topographic factor is added the fact that the threshold of the dilator is higher (than that of the sphincter) to the acetylcholine which is being liberated from time to time not far away.

Sensitization, however, can lower such thresholds, whether accomplished by denervation (as Mlle. Lánczos has shown) or pharmacologically, or by both means in superposition as in some of our experiments. When the threshold *is* thus lowered, the effector may then react to the usually "opposite" stimulus and thus reveal its *de facto* nonspecificity.

There remains the question why, if the dilator is so completely nonspecific as to react even to both adrenergic and cholinergic drugs simultaneously, there is no corresponding behavior on the part of the sphincter. Here, as was first demonstrated by Poos (1927) and confirmed by others (Yonkman, 1930; Gunter and Mulinos, 1939), adrenaline antagonizes the action of cholinergic agents. This phenomenon spotlights the role of the sympathetic innervation in the sphincter,* but it does not explain the difference in behavior of the sphincter and the dilator. The crucial difference between the two muscles, in their reactions to acetylcholine and adrenaline, is that for one of them these two drugs are antagonistic while for the other they are not.

We realize also that the Lánczos phenomenon has not been completely elucidated. Sensitization of the dilator to cholinergic drugs may be only a part of the explanation. It cannot be the whole explanation unless either: (a) the dilator can defeat the sphincter when both are contracting with full effort; or, (b) the threshold of the sphincter to its usual stimuli is somehow raised by the act of denervation.

* Which is, of course, to insure a relaxation of the sphincter whenever the dilator contracts, since the same neurohumor activates both of these processes.

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WHAT SUBLUXATED LENSES REVEAL ABOUT THE MECHANISM OF ACCOMMODATION*

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If certain facts now fully confirmed by repeated demonstrations had been available when the title for this paper was submitted several weeks ago, it might properly have been changed to "The emphatic elimination of the hypothesis of Helmholtz regarding the mechanism of accommodation."

The theory of Helmholtz has reigned supreme for more than three quarters of a century among the explanations for the mechanism by which the human crystalline lens gains the increased convexity necessary for near vision. Two reasons account for its widespread acceptance.

The first is the simplicity of the idea of the assumed relaxation of the zonule and elasticity of the lens substance. It could be told in a few words and repeated by any high school student without knowledge or understanding of the fundamental facts.

The second reason for its immediate acceptance was the tremendous authority of the great scientist, Hermann von Helmholtz, who proposed it. Regardless of his cautious announcement of the mere possibility, his idea was accepted as infallible by the scientific world of his day almost without protest. No discredit devolves on von Helmholtz because facts, subsequently discovered, rendered inapplicable an imaginery concept of his brilliant intellect. He would be the first to acknowledge that facts always are superior to fancies. Von Helmholtz remains securely intrenched in history among the greatest benefactors of the human race by his discovery of the ophthalmoscope and innumerable other scientific achievements. The tendency among some of his followers to make an inviolable fetish of Helmholtz's theory of accommodation in no way detracts from the preëminent status of the original contributor of the hypothesis.

My studies of the behavior of subluxated lenses in accommodation began about 20 years ago by the daily use of miotics for the purpose of preventing a recurrence of prolapse of such a lens into the anterior chamber. The patient was a boy three years of age to whom this accident happened one morning while romping in bed. Although in such cases the routine procedure is extraction of the lens, conditions in this case were so unfavorable that an attempt was made to get the lens back into its primary position behind the iris. The patient was placed on his back, face *up* (not "down" as apparently was assumed by one physician in discussion). The pupil was dilated by cocaine and euphthalmine 1 percent. The boy was then told to look constantly at a light fixed directly over him and, while he did so, pilocarpine (1 percent) and a tiny drop of eserine (0.5 percent) were instilled into his eye. This unique therapeutic experiment was a success. As the pupil contracted, the lens was returned to the fossa patellaris of the vitreous humor behind the iris. The child's mother asked for some method to prevent the recurrence of the accident and a 1-percent solution of pilocarpine was prescribed for daily use. The miotic was instilled in both eyes. Examination under mydriasis one month before the accidental prolapse into the anterior

* From the Department of Ophthalmology, Saint Louis University School of Medicine. Presented at the Sectional Meeting of the American College of Surgeons, Detroit, Michigan, April 2, 1940.

chamber had revealed that this lad's poor vision was caused by the irregular and variable myopic astigmatism resulting from congenital subluxation of both lenses. The zonule was defective in the upper segment of each eye, but the defect was not visible until the pupils were widely dilated, as under all ordinary conditions the body of the lens filled the pupillary opening.

The effect of the daily use of the miotic was the same in both eyes. Good miosis was obtained, but the unanticipated result was that the lenses were gradually displaced downward behind the iris, leaving an aphakial segment of the pupil above the equator of the lens through which it was hoped to secure good vision. Correction of the aphakia would not be subject to the variability in the error of refraction which baffled previous attempts to improve vision by glasses. Because this space in the upper segment of the pupil was first noted when the pupil was small, under pilocarpine, it was naturally expected that stopping the use of the miotic would give a larger aphakial area for better vision, but when the miotic was discontinued, the lenses amazingly rose up to their original position filling the pupil and obliterating the aphakial segment.

It was only then that the significance of the unexpected lenticular reaction to the continued use of the miotic became apparent. Contraction of the ciliary muscle had caused an impact of the vitreous against the periphery of the lenses in exactly the same manner as it had been demonstrated in experiments with eserine conducted on monkeys' eyes at the Fondation d'Ophtalmologique de Rothschild, in Paris, in 1906. The forward and inward movement at the periphery of the vitreous humor had been reported in 1867 by Hensen and Voelckers in the bisected living eye of a dog when the ciliary ganglion was electrically stimulated, but here was the first evidence in a living human eye not mutilated by surgical dissection.

The possibility of this transposition of a luxated lens by impact of the vitreous was demonstrated in other cases and reported to the American Ophthalmological Society in 1924. The lenses were always displaced in the direction in which the zonule remained intact. They moved away from the defective sector of the zonule. The only possible explanation was that the impact of the vitreous slipped over the edge where the zonula was defective and caused a sideslip in the opposite direction. In a private discussion after the meeting, Dr. Walter B. Lancaster, of Boston, correctly stated the challenge of these observations when he said "If what you have reported is true, then I must change the ideas I have held for a lifetime concerning the mechanism of accommodation."

The demonstration of the fact that there was a concentric impact of the periphery of the vitreous against the zonule and posterior surface of the equatorial zone of the lens when the ciliary muscle contracted, completely eliminated the hypothesis of relaxation of the zonule as a primary factor in the mechanism of accommodation. However, the transposition of lenses took place slowly, and suitable cases were not readily available. Deeply ingrained in many minds are oft-repeated familiar hypotheses. More striking and immediately recognizable evidence was desirable. This spectacular incontrovertible evidence was at hand, but apparently it awaited the direct observation by my son, Dr. Fullerton W. Luedde. One month ago, he found a suitable case of subluxation of the lens caused by a football injury, in which normal vision with glasses and a considerable range of accommodation were pre-

served. Only one eye was affected by the injury. This young man was a member of a section of the senior class of the Saint Louis University School of Medicine whom Dr. Luedde was instructing at the Eye Clinic of St. John's Hospital and Dispensary. Dr. Luedde noticed that the iridodonesis present in the formerly injured eye when the student looked at distant objects stopped when he accommodated for near objects. There was no sign of relaxation until the maximum of the accommodation for this eye (4+ diopters) was reached. The accommodation of the uninjured eye was 2 diopters more. Certainly there can be no mistaking the fact that here relaxation played no part in producing the adjustments for near vision.

In the absence of positive evidence of relaxation during accommodation as reported by Gullstrand, such observations on one case are sufficient to annihilate the theory of relaxation of the zonule for accommodation, but Dr. Luedde was able to demonstrate the same reactions in an older patient with congenital subluxation in both eyes whom he remembered having seen at the clinic some time before and recalled for the purpose of making the same tests.

His report on these two cases follows: "While discussing accommodation with a group of senior medical students of Saint Louis University, at St. John's Hospital Dispensary in January, 1940, I noted a marked iridodonesis in the left eye of one of them. He gave a history of a football injury six years before which had resulted in the subluxation of the crystalline lens in the left eye. His vision in this eye was 20/20 with correction. I recalled that my father had utilized the effect of miotics upon such luxations in his studies about the mechanism of accommodation. I felt that for purposes of demonstration the active physiological accommodative effort should be sufficient to confirm his findings. Accordingly, I directed the student to look from right to left at distant objects over 20 feet away during which movements the other students in the section as well as myself noted marked iridodonesis in the previously injured left eye. I then directed the student's attention to my finger at a distance of 1 foot from his eye, he now followed all movements of my finger without perceptible iridodonesis. We then checked his near point and found it to be 6 inches for the right eye and 9 inches for the injured left eye. The right eye thus had a normal near point for his age, 25 years. It was noted that the left eye, in which the zonule was relaxed by injury, had less accommodative capacity. I then directed his attention to an object 5 inches from his left eye, thus obtaining the maximum accommodative effort of which he was capable. Iridodonesis was again easily noted but to a lesser degree than that observed in fixation for distant objects.

"This student kindly consented to dozens of reëxaminations of these special reactions of his left eye by his classmates, by the resident ophthalmologists, and other internes, by those present at the monthly noon clinic in ophthalmology at the medical school, by faculty members of the ophthalmic department, and by the members and other physicians present at the monthly meeting in March of the Saint Louis Ophthalmic Society.* Invariably the reaction was precisely the same, demonstrating beyond question that it

* These direct personal demonstrations were subsequently repeated at the meeting of the Faculty Seminar at the Saint Louis University School of Medicine and at the Department of Physiology of Washington University, Saint Louis, and at a meeting at Chicago University under the auspices of Professor Arno Luckhardt of the Department of Physiology, Dr. W. A. Daniel having been graduated June 4, 1940, is now an interne at the Long Island Hospital, Brooklyn, New York.

was a *perfectly normal accommodative act carried on without any sign of relaxation,* simultaneously with the accommodation of the fellow eye which was uninjured. It was noted that if strong accommodative efforts were made repeatedly, the left eye, the one with the subluxated lens, seemed to become fatigued sooner than the uninjured right eye. This was revealed by the drifting or divergence of the left eye. As soon as binocular fixation was lost the eye with the traumatic subluxation would cease to accommodate and the iridodonesis would recur. Later, a cinematic recording of these reactions was made with reasonable accuracy.

"Subsequently it was arranged to make the same tests on a clinic patient, aged 35 years, who, it was recalled, had a congenital subluxation of the lens in both eyes. (Four other members of her immediate family are said to be similarly afflicted. I have not been able to examine them to date.) We were able to get from this patient a cinematic record of the wobbling during accommodative rest, tightening upon active exercise of accommodation—the same reactions that were present in the one eye previously observed in which the subluxation was the result of trauma. Her ocular trouble having existed from birth, she had never developed normal visual acuity. Her vision was only 3/120, right or left. Her near point was 10 inches for each eye, which is not far from the normal average for her age. Her lenses showed so much displacement that the equatorial border could be seen at the nasal margin of the undilated pupil.

"The significant facts noted in these eyes with subluxated lenses positively exclude from further scientific consideration any hypothesis of relaxation of the zonule as a basis for the mechanism of accommodation. They are:

"1. The subluxated lenses wobbled when accommodation was suspended.

"2. The wobbling ceased throughout the full range of active accommodation.

"3. The subluxated lenses wobbled noticeably when the maximum accommodative effort had been reached, but to a lesser degree than when accommodation was at rest. This latter phenomenon is akin to the 'Linsenschlottern' or 'trembling' or 'slipping' noted in normal eyes by many observers when active accommodation attains its climax. It has been fully explained by my father in various discussions of this problem during the last 15 years. The reason that the wobbling is less violent at the upper limit of accommodation is to be found in the fact that although active impacts of the vitreous which tighten the zonule and help to change the form of the lens as long as its cortex is soft enough to yield have stopped when the strongest effort of accommodation has been reached, the lens itself is actually supported by complete contact with the vitreous against its posterior surface. Hence, the lens trembles as he has stated somewhat like a large bead attached to a mass of jelly.

"The reason that the lens can tremble or slip downward in response to gravity is found in the fact (also reported by W. H. Luedde, repeatedly) that there is a narrowing of the internal anterior diameter of the ciliary body. The tendonous anterior tip of the ciliary muscle is pushed inward at the final thickening of the longitudinal, or Bruecke's, portion of the ciliary muscle in its extreme contraction, thus loosening the suspensory fibers

of the zonule without relaxing the tension of the accommodative bundles of the zonule which course backwards in the depression between the ciliary processes. In subluxated lenses, the suspensory fibers are traumatically relaxed in various degrees and when the accommodative bundles of the zonule are not tensed by actual accommodation, such lenses must do their most violent wobbling."

It would appear that the direct observation of the effect of normal physiological accommodation on the iridodonesis present in subluxated lenses has not been made previously probably because possible observers were saturated with the false idea that a lens which was loose in distance fixation would only become more loose when accommodated. Suitable cases for similar observations are not very plentiful, therefore it is desirable that all ophthalmologists should be on a lookout for them. However, it is not by numbers that may be added, but by the succinct fact of these observations here recorded that the theory of relaxation fails to meet test of truth. The failure of a theory to meet a fact must eliminate the theory. Obviously, future studies of the mechanism of accommodation must be made on the basis of tension of the zonule instead of relaxation. Such an outline was presented in the American Journal of Ophthalmology, 1936, volume 19, March, page 245. Its fundamental principle is "that accommodative changes in the form or position of any crystalline lens" wherever they exist in the animal kingdom "are the result of extrinsic forces actively applied." It is in full accord with all known facts concerning this mechanism and likewise affords an explanation for Gullstrand's hypothetic "intracapsular" phase of the mechanism.

The simple direct observation by Dr. Fullerton W. Luedde that *tension* of the zonule *not relaxation* occurs during the regular exercise of the physiological range of accommodation eliminates the hypothesis of Fincham based on the assumed modeling of the lens by the capsule. Fincham's theory requires primarily the relaxation of the zonule. If accommodation could be effected by the lens capsule alone there would be no change in the iridodonesis in eyes with subluxated lenses during that functional activity. It also eliminates the more fantastic concept recently proposed by Onquist which is a reversion to the Newtonian idea of a "Musculus crystallinus." The elimination of iridodonesis depends on a change of tension in the zonule and fixes the responsibility for accommodative changes in the form or position of the lens on the zonule.

Persons on opposite banks of a river may look simultaneously at the same stream and yet they may differ widely in their descriptions and interpretations of what they see. In 1904 and 1905 it was my privilege to be a voluntary assistant of Geheimrat Professor Voelckers at the Royal University Eye Clinic at Kiel, Germany. The courtesy of membership in the physiologischer Verein of the university brought cherished personal contacts with its venerable president, Geheimrat Professor Hensen. My acquaintance with this pair of scientists, Hensen and Voelckers, came nearly 40 years after they had apparently confirmed the hypothesis of von Helmholtz by their well-known experiments on dogs' eyes. A short midsummer-vacation visit in 1905 to Professor Carl Hess at Wurzburg enlarged my perspective from that side of the stream. December of 1905 found me in Paris, where it was my purpose to get the view from the other bank under the genial guidance of M. Tscherning, whose devotion to truth and accuracy was as great as that of the teachers who had captured my respect and confidence in Germany.

It was my endeavor to find some way

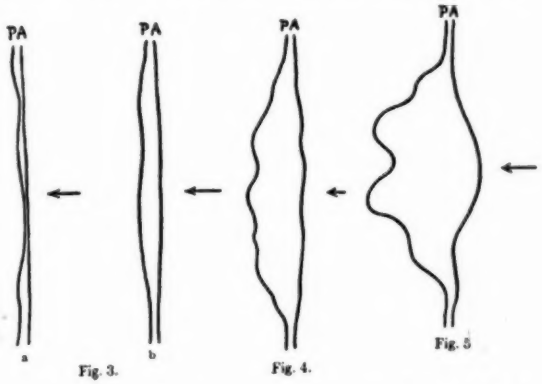
to harmonize the divergent interpretation of the same phenomena. On one point there could be no compromise. Either relaxation of or traction on the zonule must be the dominant factor. As stated in an earlier paper, some relaxation of the suspensory fibers of the zonule might facilitate the modeling of the lens, but that relaxation could be secondary only to the essential tension of the zonule in the mechanism of accommodation. Some phenomena may reasonably be interpreted both ways. For a striking example of divergent interpretations see the drawings of Basil Graves illustrating the reactions of an empty lens capsule to accommodation, miotics, and mydriatics. Basil Graves's interesting report on extensive detailed experimental studies with a slitlamp and every other facility was given to the American Ophthalmological Society at the same meeting, 1925, at which my report was submitted regarding the transposition of subluxated lenses under the influence of miotics.

Quite generally, Basil Graves's report was accepted as evidence of relaxation of the zonule as the basic factor in accommodation. Study of his reports and drawings, however, indicates that what he found actually gives support, so far as one could depend on an empty lens capsule for it, to the mechanism of accommodation as above outlined.

Presenting a study of the empty capsules in lieu of the entire lens with its capsule and attachments is akin to a review of Shakespeare's "Hamlet" without a mention of that Danish Prince. Nevertheless, that research was quite worth while. The outline of the wrinkled posterior capsule under eserine and in active accommodation can be explained best by the known fact of the concentric advance forward and inward of the anterior peripheral segment of the vitreous. Except under eserine, the anterior capsule shows little change. This corresponds to the final relaxation that has had full previous recognition.

If it were true that the lens *in situ* approached the spherical form under relaxation of the zonule, certainly the equatorial ends of the anterior and posterior capsules should show the first evidence of it. On the contrary, they are closer together, probably being held that way by the impact of the peripheral vitreous. Coordination of other apparent contradictions have been submitted in earlier papers. Whether they were disagreements about measurements of Purkinje's images or the assumed elasticity of the lens or its capsule and zonule, or other factors, the ultimate result must be that facts agree.

1402 South Grand Boulevard.



Drawings of an empty lens capsule, based on studies under varied conditions, by Basil Graves (presented before the American Ophthalmological Society, 1925).

Fig. 3 refers to the positions of the capsule with accommodation at rest or under atropine.

Fig. 4 shows position of capsules during ordinary accommodation.

Fig. 5 shows capsular outlines during ciliary spasm excited by instillations of eserine. Noteworthy is the fact that the equatorial ends of the anterior and posterior capsules are depicted as closer together in the supreme accommodative effort in figure 5.

P—indicates posterior capsule.

A—indicates anterior capsule.

PLASTIC RECONSTRUCTION OF THE UPPER LID*

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The following case is reported to illustrate a method of plastic reconstruction of the upper lid which appears superior to those methods now in general use. The essence of this method is to use the available adjacent tissues to replace excised parts with as close restoration of normal structures as possible. It is somewhat similar to the method described by Hughes[1] in 1936 for reconstruction of the lower lid. The general principles follow those laid down by Kuhnt[2] and Dupuy-Dutemps.[3] The methods commonly in use today[4, 5, 6, 7] require extensive pedicle flaps and mucous-membrane inlays but do not produce an ideal end-result. Many of the normal lid structures are not replaced in those procedures, and the functional as well as cosmetic results are not always entirely satisfactory.

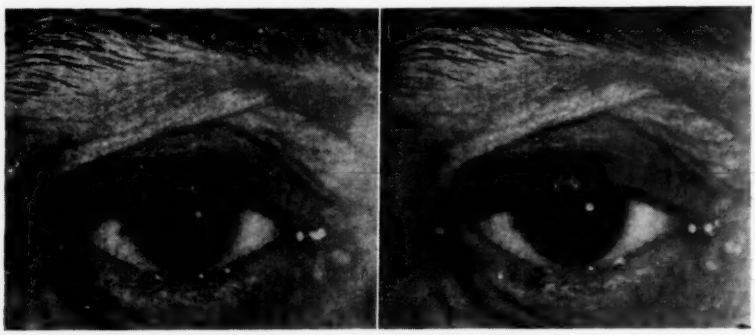

Fig. 1 (McLean). Stereoscopic appearance of the tumor.

CASE REPORT

R. K., a 47-year-old white farmer, presented himself at the Wilmer Institute on March 23, 1939, complaining of a rapidly growing mass on the right upper lid. Examination disclosed a large, firm, pigmented tumor at the lid margin 14 mm. by 5 mm. by 5 mm. in size, extending through the margin to the conjunctival surface (fig. 1). The globe was normal with corrected vision of 20/20. There was no involvement of the regional nodes. The other eye was entirely normal with corrected vision of 20/20. General physical examination was essentially negative, and there was no evidence of metastasis. Radiological consultants advised surgical approach. Because of the evident malignancy of the tumor and beginning induration around it radical excision was decided upon.

On March 30, 1939, under avertin-ether anesthesia, incisions down to the tarsal plate were made outlining the lid area to be removed (full lines, fig. 2). Relaxation skin triangles were removed at the upper corners (dotted lines, fig. 2). The underlying tarsus and conjunctiva were cut through, and the greater part of the lid surrounding the tumor was excised (fig. 3). As the superior incision was finished the end of the levator muscle was carefully isolated and secured. The lower lid was then split into two layers.

* From the Wilmer Ophthalmological Institute of the Johns Hopkins Hospital and University. Part of a paper read before the Louisiana-Mississippi Ophthalmological and Otolaryngological Society, at New Orleans, April 25, 1940.

Fig. 2 (McLean). Full-thickness excision of lid (full lines) and skin triangles to be removed (dotted lines).

The under one, consisting of tarsus and conjunctiva, was mobilized, its edge freshened and attached to the levator muscle above with buried gut sutures. A strip of orbicularis muscle was isolated from the remaining root of the upper lid and swung down over the new-formed tarsal plate. Loose skin between the relaxation triangles was mobilized and used to cover the denuded area, the lower border being sutured with fine silk to the edge of the lower lid. The other skin incisions were similarly closed with fine silk and a pressure dressing applied. Pathological examination revealed a basal-cell carcinoma. Healing was uneventful and the lids were left closed for eight weeks (fig. 4). On May 23, 1939, the lids were separated under field-block procaine anesthesia. Opening and closing of the lids were well performed. Six weeks later on July 7, 1939, a lash graft from the opposite brow was placed in the upper lid according to the method of Wheeler[8] to complete the restoration of preëxisting structures. There was complete restoration of sensory as well as motor function. The final result is shown

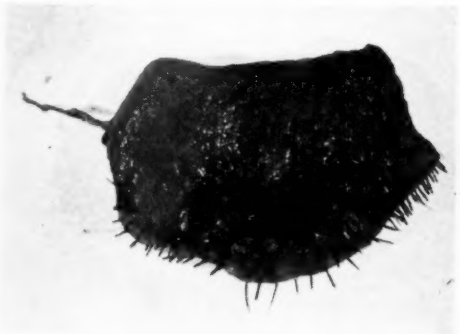

Fig. 3 (McLean). Excised lid.

Fig. 4 (McLean). Appearance eight weeks after operation before the lids were opened.

Fig. 5 (McLean). Postoperative result.

Fig. 6 (McLean). Postoperative result showing the ability to close the new-formed lid.

Fig. 7 (McLean). Stereoscopic appearance of grafted eyelashes.

in photographs taken April 15, 1940, little more than a year after the first operation (figs. 5, 6, 7).

Summary

A method of plastic reconstruction of the excised upper lid utilizing skin and orbicularis muscle from under the brow with tarsus and conjunctiva from the lower lid is described. The resultant new upper lid appears to be more nearly normal in structure and function than are those formed by methods hitherto used.

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A CASE OF SYMPATHETIC OPHTHALMIA TREATED WITH SULFANILAMIDE*

PATHOLOGICAL REPORT

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In May, 1939, at a clinical meeting of the Chicago Ophthalmological Society, I presented a boy with sympathetic ophthalmia. He had been treated with sulfanilamide and sulfapyridine, and the disease had been apparently kept under control, although it had certainly not been cured. This treatment was used because sulfanilamide has been proved to be of value in treating certain diseases caused by filterable viruses, such as trachoma and possibly herpetic keratitis, and there is considerable evidence that sympathetic ophthalmia is caused by a filterable virus. On the other hand, if one believes that sympathetic ophthalmia is really tuberculous in origin, there is experimental evidence that sulfanilamide tends to prevent the dissemination of tubercle bacilli, although it apparently does not destroy them. The following statement was made at the time the patient was presented to the meeting:

"Alphonse H., aged 11 years, weight 86 pounds, had a small penetrating injury through the limbus of his right eye with a piece of wire on November 5, 1938. There was a slight prolapse of the iris but practically no inflammatory reaction, so it did not seem to be advisable to excise the prolapse. Vision was 20/20 in each eye. The prolapse soon became covered over with epithelium. Five weeks later several precipitates were seen on the inner surface of the right eye. There was a little ciliary injection in the left eye and a posterior synechia was forming. Vision was still 20/20 in each eye. Both pupils dilated well with atropine. Treatment with sulphanilamide, gr. 40 daily, was started. After a week of this medication the temperature suddenly rose to 104°F. one day and 106 degrees the next. At this time there was one precipitate in the right eye and four in the left eye. Sulfanilamide was discontinued for four days, then, as the temperature was normal, its use was started again; but after two doses the temperature rose to 103.8 degrees and there was emesis, so it was discontinued again. Sodium salicylate was given for a week, but the precipitates appeared again and it was discontinued. Several intramuscular injections of proteolac were given, but the precipitates increased greatly in number. Sulfapyridine was administered, 40 gr. daily, and in four weeks the precipitates had completely disappeared. Sulfapyridine was discontinued, but in a week the precipitates had returned, and it was again ordered. Several injections of proteolac were given; but once more the precipitates increased greatly, and proteolac was stopped. The precipitates have slowly become fewer and smaller but have not completely disappeared.

"Two weeks ago the use of sulfapyridine was discontinued and sulfanilamide again given, this time in doses of 60 grains daily. There has been no fever and the precipitates are diminishing. The retinal veins are a little tortuous, there is no thickening of the iris, and vision about five months after the onset of the sympathetic ophthalmia is O.D. 20/20, O.S.

*From the Department of Ophthalmology, Children's Memorial Hospital. Presented at the March, 1940, meeting of the Chicago Ophthalmological Society.

20/20. While sulfanilamide was given the blood concentration was maintained at about 5.5 mg. percent. While sulfapyridine was used the blood concentration was kept at about 1.5 mg. percent. The blood count and hemoglobin have not been suppressed enough to cause concern. This is probably a mild type of sympathetic ophthalmia, nevertheless the action of both sulfanilamide and sulfapyridine seems to be definitely beneficial."

The patient had a moderate degree of secondary anemia when he was presented before the meeting and this became more pronounced so that by June 1st his red count was 2,940,000. Response to treatment was prompt, however, and on June 15th the red count was 3,880,000; on June 29th it was 4,120,000. His last eye examination was on June 28th. At this time the vision was 20/20 in each eye. There was no congestion whatever, a few small precipitates were present on each cornea and the media were quite clear in each eye. He was still taking sulfanilamide and it seemed quite probable that the inflammatory process would eventually heal without destroying his sight.

On June 29, 1939, he fell from a bicycle onto a picket fence and sustained a perforating wound in the abdomen. He died the next day from a very extensive hemorrhage into the retroperitoneal space. His parents had been most appreciative of our efforts to preserve his sight and readily consented to postmortem enucleation of both eyeballs. They have thus been made available for study. Serial sections were stained so that an accurate estimate could be made of the degree of involvement in each eye.

Pathological findings

Right eye (injured eye). There was an old healed scar through the cornea 3 mm. from the limbus at the temporal side. The iris was adherent to this scar but did not extend all of the way through; that is, it was not completely prolapsed. There were perhaps 50 lymphocytes in the anterior chamber, in any one section, most of them near to or in contact with the endothelium of the cornea. The aqueous contained more albumen than usual and some fibrin. There was typical nodular and diffuse infiltration of the iris and ciliary body by lymphocytes and epithelioid cells. In most of the sections the nodular aggregations of cells were found at the root of the iris, under the sphincter muscle, in the pars plana of the ciliary body, and in the uveal tract just adjacent to the ora serrata. Some giant cells were present in the ciliary body. In some sections the sympathetic tissue had broken through the pigment layer of the pars plana of the ciliary body and a few cells were found in the adjacent vitreous, but the refractive media as a whole were almost normal. There was one collection of cells in the choroid posterior to the equator but otherwise the choroid and retina were normal. The disc was moderately edematous. There was no caseation, no fibrosis, nor other evidence that any healing process had taken place.

Left eye (sympathizing eye). The cornea was normal. In a few sections several lymphocytes were seen adhering to the endothelial surface. The aqueous contained very little more albumen than normal. There was one large nodule near the root of the iris which was composed chiefly of epithelioid cells and chromatophores with very few lymphocytes; it definitely gave the impression of being in a healing stage. Elsewhere in the iris there was a little diffuse infiltration by lymphocytes. There were places in the pars plana of the ciliary body where lymphocytes were massed solidly together and other places where epithelioid cells had collected in sufficient numbers to

break through the pigment layer into the vitreous. The vitreous itself was quite clear but cells were present in the retrolental space as well as on the anterior lens capsule. There were several places in the choroid behind the equator where a few lymphocytes were present, but no extensive nodular infiltration was seen. The retina was normal. The disc appeared to be somewhat edematous.

These findings prove that we were dealing with a case of sympathetic ophthalmia. It is most encouraging to know that the use of sulfanilamide did cause clinical improvement in a proved case and that normal vision could be maintained for at least six months. It is interesting to see that the process was quite definitely limited to the anterior segment and that the media were fairly clear. On the other hand, it is disappointing to find as much active pathology in eyes which looked so well clinically when it is fairly evident that the patient had had about as much sulfanilamide as could safely be given.

Children's Memorial Hospital.

THE LIMITS OF TYNDALLIMETRY IN THE ANTERIOR CHAMBER*

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In Hackh's chemical dictionary[1] tyndallimetry is defined as "the estimation of the suspended matter in a solution by measuring the intensity of the scattered light from a Tyndall cone." A Tyndall cone, in turn, is defined as "the path of light passing through a heterogeneous medium, made visible by means of the solid particles, as, for instance, a light beam passing through a colloidal solution." During illumination of the eye with the slitlamp, a Tyndall cone is produced in the anterior chamber by the particles of colloidal or supracolloidal size suspended in the aqueous. Since these particles are mostly protein molecules, the intensity of the light beam in the anterior chamber may be considered as being directly dependent upon the protein content of the aqueous. Estimation of the intensity of this beam with the corneal microscope has become a routine method of examination.

With regard to the normal aqueous humor, Vogt first[2] stated that "it was relatively optically empty and therefore dark. The presence of exudates and cells is betrayed by the luminous shaft becoming visible in the anterior chamber. In this manner we are able to detect the most minute diffuse exudation in the aqueous." Two years later[3] Vogt reported that the optical emptiness of the anterior chamber is not an absolute one. If the well-focused beam is thrown into the eye in such a way that, (1) the upper border of the beam comes to lie approximately in the center of the pupillary area, and (2) the focal stretch of the beam lies in the anterior chamber, the border of an extremely faint beam becomes visible in normal eyes. What one perceives under these conditions is an extremely slight difference in luminescence between the portion of the chamber traversed by light rays (hereafter, in analogy to the corneal section, designated as the aqueous section) and its immediate surrounding. This phenomenon is usually so faint

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that I did not trust my own power of observation in this matter. Its existence, however, is beyond doubt because I had it "discovered" by several ophthalmologists well versed in the use of the slitlamp but unfamiliar with Vogt's aforementioned paper. This physiological Tyndall cone, however, can be noticed only under the most favorable conditions—wide, absolutely black pupil, clear cornea, deep chamber, well-focused beam—and then only by comparing the aqueous section with its immediate neighborhood. The visibility of a Tyndall cone in the anterior chamber would thus seem to depend, on the one hand, upon the absolute intensity of the cone (the concentration of colloidal or supracolloidal particles in the aqueous section) and, on the other hand, upon the degree of darkness in the portion of aqueous that surrounds the aqueous section and thereby serves as background during the tyndallimetry. The darkness of this portion of aqueous depends chiefly upon the amount of light that is diffusely scattered in the anterior chamber by regular and irregular reflection taking place on the anterior surfaces of iris and lens.

Table I

PROTEIN CONTENT OF AQUEOUS IN NORMAL AND DISEASED ANTERIOR SEGMENTS

Hospital Number	Diagnosis	Date of Examination	Nature of Fluid (Primary or Regenerated)	Intensity of Light Beam in Anterior Chamber	Protein Content of the Aqueous mg. %
55600	Chronic retrobulbar neuritis BE				
	RE (butyn)	9- 8-36	Regenerated	−	149
	RE (cocaine)	10- 9-36	Regenerated	−	37
	LE (butyn)	9- 7-36	Regenerated	+	270
	LE (cocaine)	10-16-36	Regenerated	−	54
14093	Mild chronic iridocyclitis, few small precipitates, a few posterior synechiae	2-13-37	Primary	−	104
		2-22-37	Primary	−	114
		4-27-37	Primary	−	98
		5- 3-37	Primary	−	160
55834	Chronic retrobulbar neuritis	10- 9-36	Regenerated	−	174
55860	Tumor of the maxilla, normal eye	9-12-36	Regenerated	+	320
56279	Mild chronic cyclitis, small precipitates	10-21-36	Primary	++	602
58221	Chronic iridocyclitis BE, seclusio and occlusio pupillae, iris bombé, shallow chamber				
	RE	3-24-37	Primary	+	1320
	LE	3-24-37	Primary	+	3760

These considerations would lead one to expect that in many of the clinical situations in which recognition of an increased protein content of the aqueous would be of value the conditions are unfavorable for the detection of a faint beam. In cases of chronic anterior uveitis, for instance, the cornea may be less transparent than normally, the anterior chamber shallow, and the pupil narrow and occluded by a gray membrane—all of

which factors make the detection of a faint beam difficult. My associates* and I have therefore endeavored to determine the minimal protein concentration that can be recognized as a definite Tyndall cone, or "aqueous flare" as the English authors call it, in eyes which, at the time of examination, did not represent conditions ideal for the recognition of a faint beam. For this purpose three patients with chronic anterior uveitis (14093, 56279, 58221) and three patients with normal anterior segments (55600, 55834, 55860), from which the genuine aqueous had been withdrawn by needle puncture one hour before, were chosen. In all cases, immediately after the slitlamp examination for the presence of a beam, the contents of the anterior chamber were aspirated with a gauge-27 needle and the protein content determined after the method of Franceschetti and Wieland.[4]

The principle of this method is the estimation of the turbidity produced by the addition of sulphosalicylic acid to the diluted aqueous. The intensity of this turbidity is, within certain limits, dependent upon the protein content of the aqueous. The turbidity is measured by comparing it, in a so-called nephelometer, with the turbidity produced in a standard protein solution. In the experiments reported herein, horse serum, provided by the National Bureau for the Prevention of Infectious Diseases in Peiping, served as standard. This serum contained thymol as a preservative and had been kept in the refrigerator at a temperature of +6°C. for several months. Its protein content was checked about once a month by determining the protein-nitrogen content gasometrically. In calculating the protein content of the aqueous the assumption was made that 1 mg. of aqueous protein produces the same turbidity as 1 mg. of protein in the horse serum dilution. This assumption was recently found to be not altogether correct. The figures for the protein content of the aqueous given in this paper should, therefore, be regarded as only relative and not absolute values.

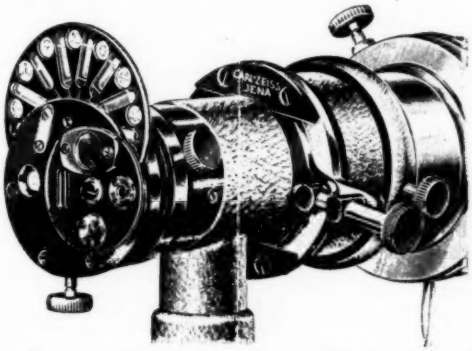

Fig. 1 (Kronfeld). The colloidometer of Roenne mounted behind the slit of Gullstrand's model of the slitlamp.

The slitlamp examinations were made with the usual rectangular beam as well as with a small round beam, the results as far as visibility of the Tyndall cone was concerned being the same. The intensity of the beam was designated as minus if no luminescence of the aqueous section as compared to the nonilluminated portion of the chamber could be discerned, as plus if there was slight, but definite luminescence, and as 2 plus if the luminescence was pronounced ("heavy beam"). Table 1 shows the lowest protein concentration that causes visible luminescence of the aqueous section to lie within the range of from 174 to 270 mg. percent. The actual threshold value is bound to vary somewhat depending upon how favorable the optical

* The work reported herein was done with the kind assistance of Drs. S. L. Chen, C. K. Lin, and T. H. Luo, of the Department of Ophthalmology of the Peking Union Medical College.

conditions are for the detection of a beam in the particular anterior chamber. The average for the visibility threshold appears to be around 230 mg. percent, which is about 10 times as high as the normal protein content. The conclusion seems justifiable that increases in protein content up to 10 times of the normal amount ordinarily may cause no visible luminescence of the light path in the anterior chamber and may therefore not be recognized.

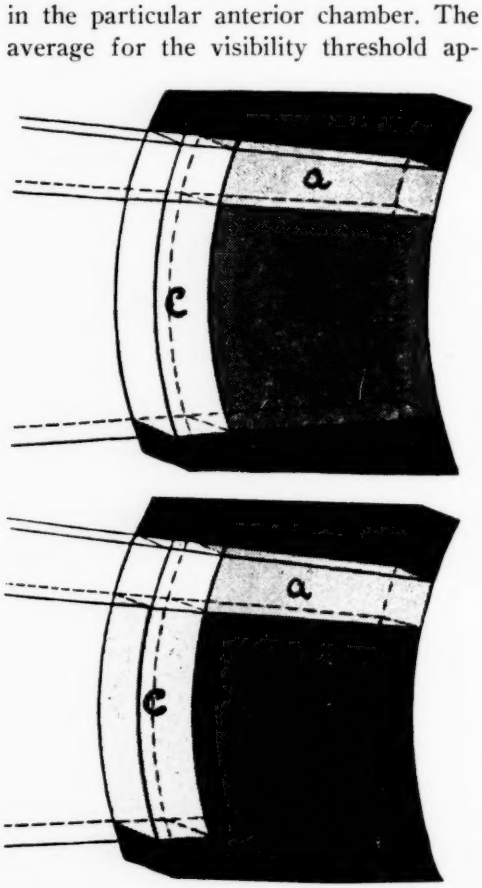

Fig. 2 (Kronfeld). The principle of colloidometry. The photo-luminescence of the aqueous (a) is compared with the photo-luminescence of the lower four fifths of the corneal section (c). In the upper part of the diagram the photo-luminescence of c is more marked than that of a. In the lower part, a and c are equally luminescent.

In 1936 Roenne[5] introduced a new principle into tyndallimetry in the anterior chamber. He designed an accessory to the slitlamp which he called a "colloidometer." It consists of a set of 12 neutral-gray filters on the order of Tscherning's photometric glasses which are mounted in a rotary disc in such a way that each filter can be made to cover the upper four fifths of the slit (fig. 1). Thereby the light intensity received by the lower four fifths of the corneal section can be varied within the limits of 1 to 1/3200. The upper fifth of the corneal section and through it the portion of the anterior chamber behind it receives the full amount of light. By turning the disc containing the gray filters, the amount of light falling upon the lower four fifths of the corneal section is reduced until the intensity of the luminescence of this portion of the cornea equals the luminescence of the aqueous section that receives the full amount of light through the upper fifth of the corneal section (fig. 2). The gray filter with which the match is obtained is a measure of the protein content of the aqueous. In this paper the amount of light transmitted by the photometric glasses is expressed in fractions of the amount of light received (transmission factor).* For the 12 glasses contained in the colloidometer the amounts of light transmitted were: 1/3.2, 1/5.6, 1/10, 1/18, 1/32, 1/56, 1/100, 1/180, 1/320, 1/560, 1/1000, and 1/3200. In principle, Roenne's method of colloidometry is a form of tyndallimetry in which the cornea is used as the standard, the assumption being that the luminescence of the cornea does not vary.

The colloidometer is easily attached to Gullstrand's model of the slitlamp where it does not interfere with the use of the lamp for purposes other than tyndallimetry. For the latter, Roenne suggests narrowing the slit considerably so as to ren-

* Roenne uses as measure of the strength of the filters the logarithms of the reciprocals of the transmission factors.

der the corneal section more homogeneous. The actual measurement requires only a few seconds. My associates and I often found that a satisfactory match was obtained with two immediately adjoining gray filters, which observation would suggest the accuracy of the colloidometer values on six patients (table 2). States of increased protein content of the aqueous were again produced by withdrawing the primary aqueous. Unfortunately, only one case of chronic anterior uveitis was available during the period devoted to this work. There was, on the whole, a

TABLE 2

RELATION BETWEEN COLLOIDOMETRIC READINGS AND PROTEIN CONTENTS OF AQUEOUS

Hospital Number	Diagnosis	Date of Examination	Nature of Fluid (Primary or (Regenerated)	Transmission Factor of Filter	Protein Content of the Aqueous in Mg %
67427	Senile cataract almost mature				
	RE	5-23-39	Primary	1/560	19
	LE	5-23-39	Primary	1/560	17
66556	Syphilitic optic atrophy				
	RE	6-13-39	Primary	1/560	14
	LE	6-13-39	Primary	1/320	27
407631	Healed retrobulbar neuritis				
	RE	7- 6-39	Primary	1/320	13
		7- 6-39	Regenerated	1/180–1/100	180
	LE	6-2-39	Regenerated	1/320	16
		6-2-39	Regenerated	1/180–1/100	80
	RE	7-12-39	Primary	1/320	20
		7-12-39	Regenerated	1/180–1/100	158
67462	Senile cataract mature				
	LE	5-25-39	Primary	1/560	16
			Regenerated	1/180	104
67414	Chronic iridocyclitis of BE moderately severe, shallow chamber, seclusio pupillae				
	RE	5-23-39	Primary	1/180	800
	LE	5-23-39	Primary	1/180	1000
	LE	5-30-39	Primary	1/56	1950
	RE	6-20-39	Primary	1/320	740
	LE	6-20-39	Primary	1/100	1200

readings to be less than ±50 percent. The manufacturer's pamphlet[6] states that the filter of the transmission factor 1/320 represents approximately the upper border of normal. Light beams in the aqueous requiring stronger filters for a match are stated to indicate an abnormally high protein content.

Being unable to find in the literature any data on the relationship between colloidometric readings and the respective protein contents of the aqueous, my associates and I determined both of these fair parallelism between the colloidometric readings and the respective protein contents. In eyes with protein contents up to 27 mg. percent, the colloidometric readings varied from 1/1000 to 1/320. Our knowledge concerning the variation of the protein content of the aqueous in normal eyes is still very meager, but it is probable that a protein content of up to 30 mg. percent may be considered as normal. In the cases in table 2 in which the protein content was from 3 to 6 times higher than normal, the colloidometric

readings varied from 1/180 to 1/100. Increases in protein content of that magnitude could thus readily be recognized with the aid of the colloidometer, whereas increases of only 100 percent above the normal value, corresponding to protein contents of from 40 to 60 mg. percent, would probably not have been recognized with certainty. These observations tend to support the statement made by the manufacturer that the filter with the transmission factor of 1/320 represents the upper limit of normal.

With the help of the colloidometer it is possible to recognize protein contents of from 80 to 180 mg. percent which, without the colloidometer—that is, by direct observation of the beam in the anterior chamber—cannot be recognized, as we have shown in the earlier part of this paper. The question arises, why lower protein concentrations of the aqueous are detected with the colloidometer than without it. The reason for this difference in sensitivity between the two methods lies, I believe, in the fact that with the colloidometer the tyndallimetric standard —namely, the corneal section—can be varied in intensity to render visible—by contrast—and, finally, to match even a very faint Tyndall cone in the aqueous; whereas, in the case of observation without the colloidometer the standard—that is, the luminescence of the portion of the anterior chamber surrounding the aqueous section—varies from case to case, depending directly upon the amount of light scattered in the anterior chamber by reflection occurring on the anterior surface of iris and lens. The observer has no control over the luminescence of this standard and may, therefore, in a case of strong luminescence of the standard but weak luminescence of the aqueous section, not be able to recognize the latter.

The colloidometer was designed primarily to determine the course, whether progressive or regressive, of anterior uveitis. Table 2 shows definite parallelism between the colloidometric readings and the respective values for the protein content of the aqueous in one case of chronic iridocyclitis (67414). On the whole, however, the transmission factors of the filters which matched the aqueous section in this case were lower than we expected from our experiences on the other cases (67427, 66556, 407631, 67462). This fact suggested the possibility that perhaps the standard, the corneal section, gave an abnormally strong Tyndall cone in the case of chronic iridocyclitis, which, clinically, would have been understandable. The question arose how differences in luminescence between clinically clear corneae could be detected and perhaps even measured. This, I found, can be done by inserting a strongly curved contact glass and filling the space between cornea and glass with a serum dilution of suitable strength. Then, again with the aid of the colloidometer, the intensity of light over the lower four fifths of the corneal section is lowered until its Tyndall cone matches the beam emitted by the serum dilution that is situated in front of the upper fifth of the corneal section. With this method it can be shown that in cases like our 67414 the luminescence of the corneal section is abnormally increased.

Summary

1. While under ideal conditions slitlamp illumination brings out a very faint Tyndall cone or beam in the normal aqueous humor, under less favorable conditions protein contents of the aqueous up to 10 times of normal may not manifest themselves as a definite beam.

2. The colloidometer of Roenne, an accessory to the slitlamp, permits estimation of the intensity of the Tyndall cone in the aqueous by comparing it with the

Tyndall cone of the lower four fifths of the corneal section, the intensity of which is reduced by means of neutral gray filters.

3. There is, on the whole, fair parallelism between colloidometric readings and the respective protein contents of the aqueous.

4. The colloidometer is of definite value for the detection of faint beams under unfavorable optical conditions.

5. The colloidometric standard, the Tyndall cone of the corneal section, is not absolutely constant. A method is devised by which, again with the aid of the colloidometer, the Tyndall cone of the cornea can be measured and standardized.

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VAN DER HOEVE'S SYNDROME*

FOUR OCCURRENCES IN THREE GENERATIONS OF ONE FAMILY

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About 86 years after Henzschel in 1831 and Gescheidt in 1832 first described "blue sclerotics," Van der Hoeve of Holland recognized that blue sclerotics in more than 60 percent of the cases were associated with otosclerosis and fragilitas ossium and that there was a decided hereditary tendency to develop this condition. This was in 1917. No cases were reported from 1832 until 1880, when Eddowes described it. Spurway in 1896, Burrows in 1911, Adair-Dighton in 1912, and Franke in 1924 all described blue sclerotics and noted a decided tendency towards fractures in their cases. Adair-Dighton in 1912 noted the feature of deafness but Van der Hoeve, in 1917, connected the triad together, and this syndrome now bears his name.

This is a congenital or intrauterine condition of unknown etiology in which the sclera is uniformly light blue in color and is associated with abnormalities in other supporting tissues of the body involving more especially multiple fractures or dislocations and associated with the later development of otosclerosis.

Duke-Elder in his last text has reviewed the subject rather completely and he believes the discoloration to be due not to scleral pigmentation but rather to opaqueness of the coat, which allows the uveal pigment to shine through, the blue color having therefore a physical basis somewhat similar to that of a blue iris.

The anatomical cause of the transparency has been a subject of dispute, and no authoritative statement is at hand. The recent case of Sugar, in 1938, in which the child died of multiple fractures, showed a normal amount of scleral thickness, and an otherwise normal eye. This eye is now in the museum of the Illinois Eye and Ear Infirmary, Chicago.

This condition has been noted in in-

* Presented before the Chicago Ophthalmological Society, April 15, 1940.

trauterine life, others have noted it in early life (osteogenesis imperfecta), and in these cases the prognosis is grave. At other times the condition develops after infantile life (osteopsathyrosis); in these cases the prognosis to life is good but malunion from fractures may lead to deformities, and deafness may become a physical handicap. As a rule, fractures are less painful than normally, but union is not delayed—and the tendency to fractures decreases as age advances.

X-ray studies of the bones reveals that the structure is more delicate than normal. One of my patients, whose case I am reporting, has a daughter who does not have blue sclerotics, but her long bones show marked decalcification. This may be an early indication of what is to come; she is at present 13 years of age.

As has already been mentioned, deafness was first noted in 1912 by Adair-Dighton, but Van der Hoeve and de Kleyn, in 1917 recognized that more than 60 percent of these patients had otosclerosis and that it comes on usually at about the age of 20 years. This was true in three of my cases.

That the syndrome has an hereditary tendency has been definitely proved. It has been found several times in four or five generations. In my series I found it in three generations; so a nonhereditary tendency is exceptional. In my cases only two of a total of six escaped it. According to Friedberg (1931) 60 percent of individuals with blue sclerotics have fragilitas ossium, 60 percent have otosclerosis and 44 percent have all three defects. These figures are probably correct. It would seem that the three defects are germinally independent but genetically linked.

In this paper I wish to report four patients whom I have seen and photographed personally. There was another, the grandmother of my patients, who had blue sclerotics but whose demise several years previously precluded my including her except to use her as the start of my family-transmission plan. Two of my patients are males, two are females. One is the mother of the other three and her present age is 80 years. The three children are now ranging about 50 years of age and all present typical cases of Van der Hoeve's syndrome.

Case 1. As has been said, the mother is now 80 years old. She is very short in stature, less than four feet high, but it is not known that her lack in height is due in any way to osteogenesis imperfecta. She was born with blue sclerotics and did not become deaf until 30 years of age, when she gradually lost her hearing from unascertained causes. At the present time she is stone deaf and badly deformed. She knows definitely that her mother had blue sclerotics but that her grandmothers and grandfathers did not. The results of her blood calcium and phosphorus determinations will be listed later. Judging from her deformity it is reasonable to presume that she at one time suffered from defective bone development.

Case 2. Mr. A. S., aged 47 years, was born with blue sclerotics and first lost his hearing at about the age of 19 to 20 years. Examination revealed that he has otosclerosis. He has had frequent fractures of the forearms, usually without pertinent causes. On one occasion he described it as "simply pulling his arm" and he found it had been broken. All the fractures were quite painless and healed uneventfully. He thinks he has had nine fractures of the left forearm.

Case 3. Mr. J. S., aged 45 years, was also born with blue sclerotics and his hearing was lost at approximately the age of 20 years. He associated his loss of hearing to a mild trauma, not knowing that it was to be part of this syndrome. During his lifetime he has had three fractures of the forearms due to mild traumata. Learning early that he

had a predisposition to fractures, he has exercised a great amount of care in his occupation. Like his brother, his fractures were quite painless and healed uneventfully. His otosclerosis is more pronounced in one ear, although his loss of hearing is approximately 90 percent (total).

Case 4. Mrs. K., aged 50 years, sister of the two last mentioned men, was also born with blue sclerotics, perhaps the most pronounced in the four cases, and during her lifetime she has had only one fracture, from a minor trauma. Her development of otosclerosis did not occur until after she was 25 years old; she has one ear that functions to the extent of 20 percent. Learning early that her family was predisposed to fractures and dislocations, she has exercised extreme precaution toward any form of trauma, which might explain her history of only one fracture.

Blood calcium and blood phosphorus

A quantitative analysis of the blood calcium and phosphorus was made in the cases of the four patients reported here and also in the two other remaining members of the family not afflicted with the disease. The members in whom the syndrome was found had a low amount in each case, although not startling, and the two normal members of the group showed normal amounts of the two elements. The results in the cases reported are as follows:

Case No.	*Blood Ca*	*Blood P*	*Remarks*
1. Mother	7.53	2.19	Low
2. Son Albert	7.99	1.99	Low
3. Son Jake	8.01	1.96	Low
4. Daughter Ella	8.00	2.00	Low

The one sister who escaped the disease had a blood calcium of 10.03 and phosphorus of 3.01 and the only granddaughter had a blood calcium of 9.55 and phosphorus of 3.00.

As mentioned before, the etiology is unknown. Takahashi in 1924 noted a decrease in calcium, which coincides with the results in my four cases, but Franke in 1924, Paal in 1929, and Stevenson and Cuthbertson in 1931 found a disturbance in calcium metabolism. The usual view is that it occurs in cases of hyperparathyroidism. In 1925, Borel found atrophy of the parathyroids. In 1924, Stobie found tetany associated with the blue sclerotics, and in 1922 Gutzeit associated it with adiposity. Nothing else in the literature has shed any further light on the subject.

So far no treatment has been of any value, but if any case of hyperthyroidism can be made out, there is evidence that this may be controlled by X-ray therapy. In the case of the granddaughter of my first subject I found quite a normal amount of calcium and phosphorus metabolism; however, on X-raying the long bones it was noted that there was a striking amount of decalcification and it seems justifiable that in her case, even though she is not afflicted with blue sclerotics and the other parts of the syndrome, it would be well to fortify her with unusually large amounts of calcium and phosphorus and vitamins to forestall if possible any of her successors having this affliction.

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THE DISTRIBUTION OF SULFAPYRIDINE BETWEEN BLOOD, AQUEOUS HUMOR, AND CORNEA*

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In the course of a study of the effect of sulfapyridine on experimental pneumococcus ulcer in the rabbit, it became important to compare the relative concentrations of the drug in the cornea, the blood, and the aqueous humor.

Since the absorption of sulfapyridine in the rabbit is very erratic, as has been pointed out by Long and Bliss[1] and as we found also in our own experiments, no attempt was made to give the drug according to body weight. The rabbits were forced to swallow a suspension of 1.2 gm. of sulfapyridine from a pipette. At the time intervals indicated in table 1, blood was obtained by heart puncture and the animals were killed immediately by air injection. The aqueous humor was aspirated and the cornea removed by a dissection made 0.5 mm. from the limbus. The weighed corneae of both eyes were ground in a small porcelain mortar with ignited and washed quartz sand in general accordance with the procedure of Bellows and Chinn.[2] The cornea and sand mixture was left standing overnight in the icebox with 6 c.c. of 10-percent trichloracetic acid to insure complete extraction of the drug. Sulfapyridine was determined by the colorimetic method of Marshall.[3]

From the data in table 1 it may be seen that in the first few hours the drug concentration in the cornea followed in its general trend the drug concentration in the blood and aqueous humor, but that after 7 hours the corneal concentration was equal to or higher than the blood concentration in 10 of 15 animals, and that after 7.5 hours this relationship was obtained in 8 of 9 animals. In an effort to find an explanation for this finding, which was surprising in view of the low water content and slow fluid exchange of the cornea, the adsorption of the drug by the cornea was studied.

Two weighted corneae were suspended for 4 hours in 20 c.c. M/15 phosphate buffer of pH 7.2 containing 10 mg. percent of sulfapyridine. After being carefully washed by repeated rinsings in M/15 phosphate buffer, they were weighed again and treated as in the animal experiments. The weight increase of the corneae was calculated as 10 mg. percent of sulfapyridine solution and an

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equivalent amount of sulfapyridine was substracted from the final result. Even so, the corneae were found to contain 10.5 and 10.2 mg. percent of sulfapyridine, respectively.

Two other pairs of corneae were ground with 1 gm. each of sand and 5 c.c. M/15 phosphate buffer of pH 7.2 containing 10 mg. percent of the drug. The sulfapyridine concentration in these experiments was 14.2 and 13.4 mg. percent, respectively.

These latter experiments were repeated with sulfanilamide replacing the sulfapyridine. Two whole corneae were suspended for 4 hours in 20 c.c. M/15 phosphate buffer of pH 7.2 containing 10 mg. percent of the drug. The sulfanilamide concentration was then found to be 12.5 mg. percent after an equivalent amount of sulfanilamide, calculated from the weight increase of the corneae, had been subtracted. Ground corneae suspended in 10 mg. percent sulfanilamide contained, after subtraction of the blanks, 39.0 and 35.5 mg. percent, respectively.

TABLE 1

DISTRIBUTION OF SULFAPYRIDINE IN RABBITS

Time Since Last Intake of Sulfapyridine	Sulfapyridine in			Body Weight kg.
	Blood mg. % vol.	Aqueous mg. % wt.	Cornea mg. % wt.	
4½ hrs.	20.0	14.1	8.5	2.41
5	11.1	7.8	8.8	2.33
5½	15.4	10.5	12.1	1.78
6	4.0	2.8	*4.3*	2.30
6	0.7	0.5	unreadably low	1.78
6	4.2	2.3	3.6	2.68
7	15.4	10.7	13.4	1.98
*7	8.3	5.6	7.5	2.18
7	1.7	1.5	*2.9*	2.83
7	2.2	1.7	*4.1*	2.13
7	12.5	6.6	11.8	1.68
7	1.1	0.6	unreadably low	2.10
7½	10.0	7.6	*15.7*	2.53
*8	1.1	0.7	*1.7*	2.08
8	1.2	0.9	*1.5*	2.86
8	3.2	*3.2*	*5.6*	2.20
8	7.1	4.8	7.0	1.47
*8	1.6	1.4	*1.7*	1.85
8½	1.1	*1.3*	*1.7*	1.80
9	3.3	1.9	*3.3*	2.45
*10	1.7	0.9	*1.8*	2.12

* These rabbits were given only one dose of 1.2 gm. of sulfapyridine.
The concentration in cornea was equal or higher than in blood—from 7th hour, 10 out of 15, or 66 per cent; from 7½ hours, 8 out of 9, or 90 percent.

DISCUSSION

It is evident from these experiments that sulfapyridine and still more so sulfanilamide, at physiological pH, are strongly adsorbed by the corneal tissue. This adsorption apparently accounts for the fact that the drug concentration was

found to be higher in the cornea than in the blood in the *in vivo* experiments, and this, in turn, may account for the curative effects of sulfanilamide on trachomatous lesions of the cornea.[4]

Bellows and Chinn[2] compared sulfanilamide concentrations in blood and in ocular tissues. In their experiments cornea and sclera were considered in combination. It is of interest that in one instance (table 2 of their paper), they found a higher concentration in the corneoscleral layer than in any other tissue or in blood. They found, further, that in the lens the drug concentration remained higher than in the blood for a considerable time. They interpreted their results as indicating "that simple diffusion is the chief mechanism in operation and that the tissues do not act to concentrate the drug," but it seems to us quite difficult to explain the high drug concentration in the lens as the result of a simple diffusion mechanism.

It might be interesting to compare the adsorption of the drug by susceptible and nonsusceptible bacteria since beside the possible oxidation of the drug to the hydroxylamine[5, but see 6] its concentration on and in the bacteria might be an important factor in chemotherapy.

Conclusions

A study of the distribution of sulfapyridine between blood, aqueous humor, and cornea of experimental rabbits revealed that after 7 hours the cornea attains a drug concentration equal to or higher than that attained by the blood.

In vitro experiments demonstrated that whole or ground up cornea concentrated the drug by adsorption. In similar experiments with sulfanilamide the cornea attains a drug concentration 3.5 to 4 times greater than that of the buffer solution in which it was suspended. Sulfapyridine was concentrated only 1.4 times.

We wish to thank Merck & Co., Inc., of Rahway, N.J., for supplying the sulfapyridine.

630 West One Hundred Sixty-eighth Street.

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NOTES, CASES, INSTRUMENTS

BILATERAL METASTASIS TO THE EYE FOLLOWING CARCINOMA OF THE BREAST

AUGUST F. JENSEN, M.D.
Grand Forks, North Dakota

Bilateral metastatic carcinoma of the eye is sufficiently unusual that the following report may be of interest. The rarity of metastatic carcinoma of the eye is emphasized by a report from the Moorfield Eye Hospital of London.[1] During seven years 2 patients out of 276,000 who presented themselves suffered from this disease. Since Perls reported the first case in 1872,[2] 231 cases of uveal metastasis have come to light. Oatman[3] reported 30 cases found in the literature in 1903, 20 of which were metastasis from the breast. Usher[4] reviewed all of the cases that had been reported up to 1923, 110 cases, 3 of which were his own. Lemoine and McLeod[5] reviewed all the cases that had been reported up to 1936. About 70 percent of metastatic carcinomata of the eye follow carcinoma of the breast. The next in frequency is metastasis from the lungs and liver. Metastasis from the stomach, mediastinum, thyroid, suprarenal gland, ovary, prostate, rectum, and esophagus have been reported. MacDonald[6] of Toronto reported a case of choroidal chorion epithelioma secondary to terratoma of the testicle.

REPORT OF CASE

Mrs. H. H., aged 51 years, came to the office on March 21, 1939, complaining of blurred vision in the right eye which had been increasing for the last six weeks or two months. She had received a change of glasses from an optometrist a month previously for this condition but had not been relieved. There was no pain nor discomfort. The patient gave a history of having always been well during her childhood. She had been operated upon for glands of the neck at the age of 14 years. She had had four children without complications. On April 1, 1936, she was operated upon for cancer of the right breast at the Minneapolis General Hospital. She had been well since then, and stated that she had had a physical examination by her regular physician a few days previously and was told her general physical condition was good.

The eye examination revealed vision R.E. 20/200 and L.E. 20/60; with her present glasses, R.E. 20/200, L.E. 20/40. The extraocular movements were normal. Convergence was good. Lids and lashes were normal. There was no inflammation of the conjunctivae, no gross opacities of either cornea. The anterior chambers were of normal depth and were optically empty. The irides appeared normal and the pupils reacted promptly to direct light. The lenses showed incipient opacities. The vitreous was clear in both eyes. The disc outlines were clear. There was no edema nor cupping. The vessels appeared normal. There was a flat, grayish, elevation in the retina of the right eye, just temporal to and involving the macular area, of about three disc diameters in width and about two diopters elevation. There was slight pigment change over this area. The retina appeared smooth and the vessels were regular in their course over this area. There was a small area of pigment in the retina of the left eye, just below and temporal to the disc. The tension with Gradle-Schiötz tonometer was 20 mm. Hg in each eye. Vision on manifest refraction R.E. with +1.75 D.sph. ⊂⊃ +1.00 D.cyl. ax. 180° = 20/40; L.E. with

+0.25 D.cyl. ax. 180° = 20/40. The peripheral fields were normal with 2/250-mm. target. With a 2-mm. target at 500 mm. I was unable to elicit any definite scotoma on the tangent screen (fig. 1).

I called her family physician about her physical condition. He stated that his X ray showed metastasis to both lungs. The patient was told that she had a tumor in each eye which was probably metastatic

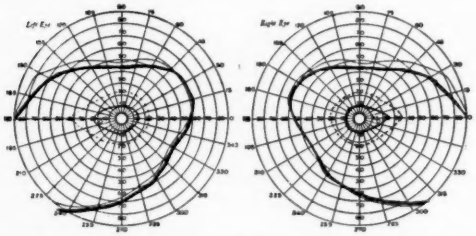

Fig. 1 (Jensen). Fields taken on March 23, 1939. Vision O.D. 20/200; O.S. 20/60. 2/250-mm. target, daylight. --- blue; —— red.

from the breast cancer. I suggested consultation, but she wished to speak to her husband first. The next morning she called me stating that they had decided that they wanted to go to the Mayo Clinic for an examination. I had a letter from Dr. A. D. Prangen of the Mayo Clinic after her visit there, stating that it was his opinion that she had metastasis in both eyes, and that X ray examination showed metastasis to both lungs and to the brain.

The patient asked me to be frank with her in outlining the course of her life as she knew that she probably had a very short time to live. She was a music teacher, so I advised her to keep on with her teaching as long as she was able, as this would help occupy her time and keep her mind off her condition. The patient asked if removal of the right eye might prolong her life. I told her that removal of the eye would be of scientific value in establishing definitely that the condition was a metastatic carcinoma, and I advised that the eye be removed only for relief of pain, should hypertension develop.

I did not see the patient again until June 14, 1939. She then had a vision with her present glasses of R.E. 20/80, L.E. 20/60. The areas involved had extended. The elevation in each eye was about five diopters. The patient was continuing her teaching of music, as usual.

The patient lived out of town and did not return to the office for observation. On November 17, 1939, I drove out to her home to see her. She was beginning to have difficulty in reading. The vision in the right eye was limited to counting fingers in the temporal field. External examination of the eyes was negative. The pupils reacted promptly. The elevation in the right eye was about six diopters, and about eight diopters in the left eye. The tension was normal. The patient had been comfortable except for some shortness of breath. She noticed that many small nodules had developed over different parts of the body.

I again drove out to see her on January 10, 1940. She had been having severe headache that day with vomiting. The headache was occipital and radiating to the top of her head. Up to this time she had been comfortable, her appetite had been good, and she had been getting about the house without difficulty. The vision in the right eye was limited to counting fingers in the temporal field. She was able to do her housework quite well. The elevation was about eight diopters in the retina of the right eye, and about 10 diopters in that of the left eye. The macular area of the left eye was now becoming involved. The retina was gray over these areas, but was smooth and the vessels took a smooth course. I could see no edema of the discs. The tension in each eye was 20 mm. Hg (Gradle-Schiötz). I did not see the patient again. She sud-

denly developed a severe headache on January 16th and died on January 20th. She was not taken care of by her regular physician and at her death no autopsy was requested. To my regret I did not know of her death until several days afterwards, for she had indicated to me that I would be permitted to examine the eyes after death.

In view of the X-ray findings of metastasis to the lungs and to the brain, treatment to the eyes was deemed of very little value. Lemoine and McLeod[5] reported treating a case of metastatic carcinoma of the eye by X ray. The right eye was first involved. This eye had to be removed due to secondary glaucoma. Two months later the left eye became involved, and a series of seven roentgen treatments was given with successful restoration of useful vision. Evans[7, 8] reports treating a case of metastatic carcinoma of the choroid with radon seeds. The patient was a woman 41 years of age. Two years after the left breast had been removed for breast cancer, a growth appeared in the left eye. The left eye was removed. Five weeks later the vision began to fail in the right eye and soon was reduced to 6/60. Four radon seeds were used with an initial activity of 1.72 millicuries each. Two months later the retina was flat and vision was 6/6. Four months later a new growth was seen on the upper outer margin of the disc and a second application of radon seeds was made with complete disappearance of the growth.

It was interesting to note the difference in development of the fundus pictures. On first examination there was an elevation of about two diopters in the right eye and apparently no elevation in the left eye. The tumor in the right eye was flat and spread rapidly, while in the left eye the extension over the fundus was much slower, but the elevation increased more rapidly. Central vision was lost in the right eye in a short time, while it remained fairly good in the left eye throughout the life of the patient. She was able to continue her work in music for several months after the eyes became involved. I believe this case demonstrates the two different types of fundus pictures described by Smoleroff and Agatston.[9] The metastasis in the right eye was by way of the long ciliary vessels, that in the left by the short ciliary vessels.

Summary

A case of bilateral intraocular tumors following operation for carcinoma of the breast is reported. When first seen, X-ray examination showed metastasis to both lungs and to the brain. The lesion in the right eye began at the equator and spread rapidly over the whole temporal fundus. The lesion in the left eye developed at the posterior pole and spread more slowly but the elevation of the tumor increased more rapidly than that of the right eye. The patient carried on her work of teaching music until shortly before her death. No sections of the eye were made, for no autopsy was obtained.

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SINGLE- AND DOUBLE-ENDED METAL SPATULAS*

CONRAD BERENS, M.D.
New York

Small spatulas are of value in expressing meibomian glands in the presence of acute and chronic meibomianitis. Because of the danger from cracked or broken glass spatulas, single- and double-ended metal spatulas† have been constructed of stainless steel. Their handles are 65 mm. in length and the flattened tips are 18 mm. in length by 9 mm. in width.

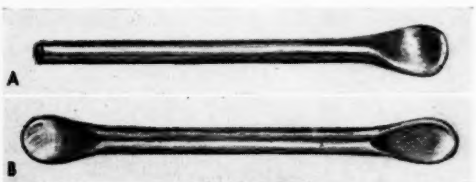

Fig. 1 (Berens). *A*, single-ended metal spatula; *B*, double-ended metal spatula.

After the instillation of a 0.5-percent solution of pontocaine, the spatula is placed against the inside of the eyelid and a finger is used for counterpressure on the outside of the eyelid. The spatula is drawn toward the free border of the eyelid, thus expressing any secretion in the meibomian glands.

The spatulas have been found especially useful for patients who express their own meibomian glands at home. The double ends make it possible to express the glands of both eyes with the same instrument without carrying the infection from one eye to the other.

477 First Avenue.

* Aided by a grant from the Ophthalmological Foundation, Inc.

† Made by E. B. Meyrowitz and Company, New York, New York.

SOCIETY PROCEEDINGS

Edited by Dr. H. Rommel Hildreth

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

October 2, 1939

Dr. Arthur M. Yudkin, *chairman*

Syphilis of the Eyes

Professor Joseph Igersheimer of the University of Istanbul, Turkey, stated that a change was occurring in the character of syphilis which was expressing itself in a greater rarity of the tertiary and malignant forms. Moreover, even primary syphilis and the congenital form with its concomitant keratitis parenchymatosa is more rarely seen. This is due to the earlier recognition and treatment of the disease.

But occasionally one still sees primary and tertiary affections of the lids such as chancres and a muco-purulent conjunctivitis in infants in which spirochetes are found.

Interstitial keratitis can early assume various forms: ring-form, rosette, disciform, nodular, and a form characterized by marked deposits on the posterior corneal surface. Later these may all merge into the more usual clinical forms. In experimental interstitial keratitis, what appears like fine precipitates are mostly new formations on the endothelium and often give rise to ruptures of Descemet's membrane and an inflammatory reaction in the deeper corneal layers. Just as in the advanced stages of the human type, experimental keratitis does not respond to antiluetic therapy. Hence the necessity for early treatment of lues. Human interstitial keratitis is basically produced by spirochetes plus other factors, perhaps of an anaphylactic nature, which still remain obscure.

In the acquired types it has frequently been shown that there is a history of congenital syphilis. There is no true immunity in syphilis and, experimentally, reinfection may occur although there may be no sign at the point of contact. In keratitis pustuliformis profunda, first described by Fuchs, though no spirochetes are found, there is always a positive Wassermann and usually—not always—antiluetic therapy is effective.

It is possible to have a luetic iritis without nodules. The involvement of the blood vessels is important here, as is shown in experimental animals. Not infrequently there is also pathology in the rest of the uvea, retina, and papilla along with the iritis. There are three luetic atrophic processes of the iris: (1) Iris atrophy in second-stage lues analogous to leukoderma which Krückmann has described as leukiridia syphilitica. This may disappear completely. (2) A type seen in conjunction with residua of an earlier luetic process, as in an old interstitial keratitis with iritis. (3) That present in diseases of the central nervous system especially with juvenile paresis with fixed pupils. The connection here is not yet clear.

Retinal changes may occur without involvement of the choroid, though both in these and in cases of chorioretinitis the vascular changes may be marked. Luetic papillitis may occur in various forms, varying in severity from slight blurring of the disc margins to the markedly protruding form.

In optic atrophy associated with tabes and paresis, as soon as pallor of the disc occurs visual-field changes are always demonstrable and dark adaptation is usually affected. It is possible for the

retrobulbar portion of the nerve to be involved first and not to appear ophthalmoscopically until late. Initial degenerative processes, which need not be inflammatory, are located at the periphery of the optic nerve. Here also spirochetes may be found not in the central portion of the nerve but in the periphery. There is no effective treatment.

Attempts have been made to traumatize the cornea of rabbits that have been injected with spirochetes, but it was not possible to produce an interstitial keratitis. Dr. Igersheimer stated that only by sympathetic irritation can the second eye in an interstitial keratitis be infected when the first eye has been traumatized. Cases of iritis with a gelatinous exudate are more typical of a gonorrheal than of a luetic infection. It is rare to find an antagonism between general syphilis and that of the eye. In a case of optic atrophy which he had followed for 10 years the patient maintained his central and peripheral fields but he received a course of treatment every year. There rarely is a central scotoma in tabes, but several such cases which he has seen went on to total blindness afterward.

Treatment of ocular syphilis

Dr. Oscar L. Levin stated that the ideal antisyphilitic drug is arsphenamine or one of its congenitors, which should be given in conjunction with a heavy metal such as mercury or bismuth. Iodides should be used in all various stages and clinical phases. In the usual case of syphilis complicated by diplopia, ocular muscle disturbances, iritis, or keratitis, especially before degenerative changes have set in, the routine methods of therapy are sufficient to prevent and cure the invasion of the ocular structures. If a Herxheimer reaction develops, treatment should not be stopped if destruction of tissues is to be prevented.

Arsphenamine and neoarsphenamine may be replaced by silver arsphenamine or sulpharsphenamine. In resistant cases with no response to routine treatment and especially with progressive changes, tryparsamide injections together with bismuth or iodides should be given for at least a year. The Swift-Ellis and the Swift-Ellis-Ogilvie methods will often reverse the spinal-fluid reaction in resistant cases and in those associated with neurosyphilis.

Malaria inoculation, biological products, and other mechanical means causing hyperpyrexia may reverse the spinal-fluid findings in over 40 percent of the cases and arrest the clinical progress in 15 percent. Patients having neurosyphilis for more than 10 years profit the least from this form of treatment.

The recent trends in the therapy of ocular syphilis offer a much more hopeful prognosis than is generally believed. The newer remedies together with those of old proved worth will greatly lessen the incidence and prolongation of ocular complications.

Discussion. Dr. Percy Fridenberg stated that there was much diversity of opinion as to the role of traumatism as a pathological factor in interstitial keratitis. This is an important point in medico-legal cases. He had asked Dr. Igersheimer what his opinion was and he answered that in tuberculosis the concept of antagonism of systemic affection to ocular involvement was widely held. Has a similar antagonism been noted in syphilis?

Dr. Mark J. Schoenberg stated that the number of optic-atrophy cases has dwindled to a marked extent. Their treatment by intraspinal injections still has some virtue. Two patients followed for the past 25 years have retained their vision with this treatment, and this may have been due to the treatment. Lauber's treatment by the reduction of intraocular pressure with pilocarpine is ineffective. In normal eyes 10-percent pilocarpine

must be used to reduce the tension.

Dr. Alfred Kestenbaum said that three originating foci in cases of primary optic atrophy have been postulated: the chiasm, the optic nerve, and the disc. Clinically and for purposes of prognosis it is necessary to distinguish three forms of primary optic atrophy: (1) The typical tabetic atrophy with early pallor of the whole disc and gradual onset of visual disturbances; (2) the pallor is more marked in the temporal sector and examination reveals a central or paracentral scotoma; and (3) the optic atrophy associated with a bitemporal hemianopic defect. It might be of interest to investigate as to whether these three clinical types correspond with the three sites of the original lesions.

Dr. Bernhard Dattner stated that in working with Dr. Wagner Jaurek he learned that treatment should be given according to the stage of the diseases. Varied opinions in the literature are due to the fact that adequate differentiation of the various stages are not made and treated accordingly. Recently a young girl at Bellevue Hospital received the malarial treatment and after some months developed an interstitial keratitis. He said that, watching some hundreds of syphilitic cases with pupillary involvement, he had found three cases only in which the pupillary responses had disappeared completely.

Dr. Levin in summarizing said that tryparsamide should not be used in the presence of any ocular trouble whatever. It should be given only when there is complete destruction of both optic nerves. Cases are more rarely seen because they are diagnosed and treated earlier. He thought it would be a mistake to neglect iodides and that they should be used in all stages of syphilis. Mercury does not have the good effect on syphilis that bismuth has.

SIDNEY A. FOX,
Secretary.

NEW YORK SOCIETY FOR CLINICAL OPHTHALMOLOGY

November 6, 1939

DR. ARTHUR M. YUDKIN, *presiding*

SYMPOSIUM OF THE CRYSTALLINE LENS

DR. ABRAHAM L. KORNZWEIG discussed the embryology of the lens in the Instructional Hour.

THE LENS AND VITAMINS

DR. WILLIAM H. BUSCHKE stated that four different vitamins have been found in the lens or are closely related to its metabolism. These are: vitamin B_1, vitamin B_2, nicotinic acid, and vitamin C. Two of these are present as parts of enzymatic systems of known nature: vitamin B_1, which is important for the normal breakdown of pyruvic acid and nicotinic or the antipellagra vitamin, which is part of two co-enzymes of the glycolytic metabolism. The role of vitamin B_2, or riboflavin in the intermediary lens metabolism is still unknown.

On the other side, vitamin C or ascorbic acid is important as part of an oxidative system, possibly together with glutathion. Vitamin C is of special interest because it is the only oxidative system known so far which occurs in high concentration not only in the lens but also in the aqueous. It may thus constitute the last link in a chain of reactions which connects the metabolic system of the lens with the oxygen of the intraocular fluid and the blood.

Vitamin C of the aqueous derives mainly from the blood and enters the aqueous through the ciliary processes in oxidized form. The normal lens reduces it, whereas the damaged lens cannot reduce vitamin C. Primary disturbances of the local vitamin-C metabolism may play a role in the pathogenesis of some kind of complicated cataracts, though this is

difficult to prove. We do not yet know how the oxidative systems of the lens, an important part of which is represented by vitamin C, are connected with the glycolytic systems, in which some vitamins of the vitamin-B group are involved.

We have learned in the last few years that some vitamins are important parts of a complicated metabolic machine in the lens which may be disturbed at any place. The fact that this recent knowledge does not yet enable us to draw important therapeutic conclusions is not discouraging. It is likely that the connection of the different metabolic systems and biocatalysts with each other is just as important for the normal function as the presence of each individual factor. After all, it is probably not incidental that all the different parts of the vitamin-B complex normally occur together.

Nor will it be incidental that in the lens these several vitamins and catalysts occur together. Of course, in order to understand the function of this complicated metabolic machine, we have first to examine, separate, and analyze the different parts. But this should not lead to overemphasis of any individual dietary factor as a key substance in the solution of the cataract problem and thus discredit efforts of science to understand not only the various parts but also the interrelation of these various parts with each other. It is to be hoped that such an understanding will eventually furnish us with a base for more specific medical therapy.

Our present knowledge of lens chemistry—a résumé

Dr. James A. Lebensohn read a paper on this subject which was published in this Journal (1940, v. 23, p. 784).

Lens lesions in eye contusions and perforations

Dr. Morris Davidson presented a series of 29 cases of permanent lens opacities following contusions or perforations of the eye. He stated that 60 percent of eye contusions exhibit lens lesions. He showed that in contusions of the first two decades of life there was no deformation of the pupil, evidences of lens subluxation and few remains of the original subcapsular lesions. This was due to the greater elasticity of the iris and zonule in the young and the greater capacity of the young lens epithelium to regenerate.

He stressed the difficulty of identifying the age of a lens opacity from its depth alone. One can only be warranted in saying that the deeper the lens opacity the older it is; the reverse, however, is not true. This was proved by illustrations of two similarly located lens opacities, one 8 months and the other 25 years after the trauma.

In a group of late traumatic cataracts observed 7, 8, and 10 years following the original perforation there was stationary good vision for many years with a sudden rapid progression of the opacification at about the age of 45 years. Whether this is a coincidence or related to the beginning senescence of the lens requires further observation. This phenomenon has considerable medico-legal importance. Obviously a minor eye contusion may be forgotten and sudden rapid deterioration years later may be attributed to a more recent and perhaps unimportant episode which may lead to errors in differential diagnosis and of causal relationship of a complete cataract. (See also this Journal, 1940, v. 23, pp. 252-271, and p. 1358.)

Simple intracapsular cataract extraction

Dr. Franklin Bracken stated it was no longer necessary to defend the intra-

capsular extraction, and that time and experience had widened the age limits and the types susceptible to such surgery.

The prime consideration for the simple cataract extraction was the patient rather than the type of cataract. A normal-appearing eye and iris are more important to the patient in the thirties and forties than in the sixties and seventies. And yet many consider that the patient under 50 should be excluded from this type of operation. Results show that the percentage of such successfully completed extractions is greater in those below the age of 50. The pathological conditions which bring about opacification in middle life, and before, apparently weaken the zonule or make it sufficiently friable so that it ruptures comparatively easily.

The possible complications are iritis, postoperative hemorrhage, prolapse of the vitreous, prolapse of the iris, and rupture of the capsule. Prolapse of the iris is the complication most peculiar to this operation, as is quite understandable. The only remedy for this is early and secure closure of the wound. When it occurs the iris is freed and replaced after a peripheric iridectomy is done. For additional security a corneoscleral suture is inserted over the site.

Discussion. Dr. Arthur A. Knapp referred to the role of vitamin-D and calcium deficiency in the production of cataract. It has been repeatedly shown that vitamin-D deficient and low-calcium diets induced cataracts in dogs.

Dr. James W. Smith said that a large number of X-ray pictures were negative in cases of intraocular foreign bodies. Is this due to faulty technique?

Dr. Buschke stated that he had purposely confined himself to the vitamins which are directly concerned with lens metabolism. It may be that the vitamin-D deficiency cataract is similar in mechanism to the tetany cataract where there is also an indirect influence in disturbance of lens metabolism.

Dr. Lebensohn said that the concussion cataract described by Dr. Davidson would be considered flocculation of the protein, which, if slight, would disappear. If it is more severe the flocculation is permanent, local autolysis sets in, and the opacity spreads.

Dr. Davidson said that not being a roentgenologist he might suggest that the clinician use other means available to him for making a diagnosis and not trust the X ray entirely.

Dr. Bracken said that in his experience the Arruga forceps tended to dislocate more than the Kalt. He believed the Arruga forceps to be better for grasping the capsule at the top as in the Verhoeff technique. In his opinion, grasping the capsule as Dr. Verhoeff does ruptures the most valuable part of the zonule at the beginning. Tumbling is a safer operation. He has changed his technique from one central iridectomy to two more laterally situated because this gave a freer flow of aqueous with less probability of iris prolapse.

SIDNEY A. FOX,
Secretary.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

SECTION ON OPHTHALMOLOGY

December 8, 1939

DR. ERLING W. HANSEN, *presiding*

EVISCERATION AND SCLERAL IMPLANT WITH PRESERVATION OF THE CORNEA

DR. FRANK E. BURCH, St. Paul, gave a talk with motion pictures on this subject, which will be published in this Journal.

Discussion. Dr. Frank N. Knapp, Duluth, said that many cases of severe eye

injuries are seen that require removal of the injured eye. The best cosmetic result possible is desired for these patients. The operation as described by Dr. Burch should prevent sinking of the lids, and give more rotation of the prothesis. The Mule operation was discouraged because of the danger of sympathetic disease. Nothing was used to cleanse the interior of the globe before the implantation of the globe. If the use of tincture of iodine followed by neutralization by a 10-percent solution of cocaine will prevent the danger of sympathetic disease. Dr. Burch has given us a real advance in this field.

Not only gold spheres but other material has been used within the sclera from time to time. Glass is slowly absorbed and may eventually break. Either gold or glass spheres will occasionally be expelled. Heated bone spheres have been advocated. These will rarely be lost.

Dr. Kenneth Phelps, Minneapolis, had performed this operation once upon the advice of Dr. Burch who saw this case in consultation. There was a very violent reaction which lasted longer than 11 days, probably due to his technique rather than the method of operation. There is now good motion of the prothesis.

George McGeary,
Secretary-Treasurer.

NEW ENGLAND OPHTHALMOLOGICAL SOCIETY

November 14, 1939

DR. J. HERBERT WAITE, *presiding*

SOME PROBLEMS IN THE RELATIONSHIP BETWEEN SYPHILIS AND THE EYE

PROFESSOR JOSEF IGERSHEIMER from Istanbul, Turkey, read a very interesting paper on the above subject. Dr. Igersheimer said there is undoubtedly a change in the character of syphilis expressing itself in a great rarity of the tertiary and malignant forms. Also, congenital lues and its concomitant interstitial keratitis do not occur as often as formerly. These changes are referable essentially to the very much improved diagnostic methods and to the subsequent early and intensive treatment following the diagnosis.

He stated that whereas in the primary and still rarer secondary affections of the lids and the conjunctiva the finding of spirochetes is of great value, demonstration of parasites in the affections of the globe during life is possible only in very exceptional cases. This is the reason for the divergence of opinions in the pathogenesis of some diseases.

Regarding the etiology of interstitial keratitis, there are authors who believe that, besides syphilis, tuberculosis also, focal infection, and other factors play a part. They emphasize that experimental syphilitic keratitis is not comparable with the human one because its course is much more rapid and it is much more responsive to antisyphilitic treatment. Dr. Igersheimer doubted that this is true and presented a series of pictures of human and experimental (metastatic) keratitis by way of comparison.

Human interstitial keratitis, well known in its familiar aspect, can have various forms. There is the ring-form, the rosette-form, the disc-form, a nodular form, and a form with very marked deposits on the posterior corneal surface. In experimental keratitis it is quite similar. Generally there is a cloudiness coming from above with deep vessels in the cornea, but sometimes in early stages, and especially when the keratitis persists for a longer period, different sorts of pictures can develop.

In human as well as in experimental

keratitis there are sometimes "precipitates," which are not real precipitates but endothelogenous neo-formations on the posterial corneal surface, which give rise to a rupture of Descemet's membrane and to an inflammatory reaction in the deep corneal layers. In animals they are not infrequently the locus for large numbers of spirochetes. It is of interest that in experimental keratitis the spirochetes more often are found in the clear portion of the cornea than in the inflamed one.

It was also evident in a large number of experimental animals that the advanced stages respond practically not at all to antiluetic therapy in spite of the still present marked inflammation of the eye.

In brief, human and experimental interstitial keratitis have many similarities and can very well be compared with each other. Dr. Igersheimer was convinced that human interstitial keratitis is basically produced by spirochetes. He said, we know that in luetic infants the cornea is the hiding place of spirochetes, but the mere presence of spirochetes is not alone sufficient to produce interstitial keratitis. There must be other factors, too, perhaps of an anaphylactic nature, which precipitate the characteristic inflammatory reaction.

The corneal affection in acquired syphilis may occur in two quite different forms: 1. As a typical interstitial keratitis. Remarkably enough it was stated in quite a number of cases that there existed a congenital and acquired luetic infection in one and the same patient. 2. As keratitis pustuliformis profunda (E. Fuchs). Yellowish infiltrates often combined with hypopyon without any superficial involvement of the cornea—especially in man—are grounds for suspecting syphilitic origin.

The significance of the vessels in pathology of syphilitic iritis was demonstrated in experimental studies.

Atrophic processes in the iris are to be seen in the following forms: (1) as spots after papular or gummatous diseases; (2) as leukiridia in the second stage of syphilis; (3) in conjunction with the residue of an earlier luetic process, as for instance in an old quiet interstitial keratitis; (4) in metaluetic diseases of the central nervous system combined with fixed pupils.

Histological studies on human and animal eyes show the way chorio-retinal changes develop. Sometimes there is a lack of pigment-epithelium and of retinal ganglion cells without any inflammation of the choroid, and sometimes the choroid is very much inflamed and contains lymphocytes, and epithelioid and giant-cells.

In the rare cases of pure retinitis, the vessels are especially involved.

In the differential diagnosis of syphilitic papillitis, there may be of help the presence of scotomata, decreased dark adaptation, opacification of the deep vitreous.

Many concepts and opinions about pathology and pathogenesis of primary optic-nerve atrophy in tabes and general paresis are not tenable. It is not, as it was believed for a long time, that the pallor of the disc always precedes functional changes. On the contrary, changes of the visual field or decreased dark adaptation or both are almost always demonstrable when the disc is pale. Whereas Uhthoff in former times saw optic atrophy in general paresis only in 4 percent of the cases, Dr. Igersheimer said he had found atrophic and other pathological retrobulbar processes in 40 percent of his histological studies. The optic nerve is much more involved than it seems from an ophthalmoscopic point of view. The pathologic process may begin behind the papilla, more often back in the

orbit, in the intracranial part of the nerve, or in the chiasm.

A further point important for the pathogenesis is the fact that the initial degenerative process is located at the periphery of the cross-section. Dr. Igersheimer said he had the opportunity to confirm this fact in such an early stage that the degeneration was to be seen only with Marchi-staining. The discussion whether the optic nerve is primarily degenerative or inflammatory can be answered in the following way: There is no doubt that in cases of optic-nerve atrophy, especially in tabes but also sometimes in general paresis, there is often no inflammatory process at all. On the other hand, it sometimes occurs that besides the degeneration there are inflammatory cells in the sheaths, especially in the intracranial part; the atrophy can be neuritic. Even a small gummatous nodule in the axial fasciculus could be demonstrated in one case.

The question is whether the spirochetes can be considered the cause of the process in the optic nerve. In an extensive study it was apparent that the parasites could be shown in a certain number of cases, not only of paresis, but also occasionally of tabes. They have been found only in the pial and arachnoidal tissue, in the peripheral septa of the optic nerve, and surrounding the small marginal vessels, up to the present only in the intracranial portion. Because of these findings it may be that not the spirochetes themselves but their toxins are of importance for the development of the degenerative process.

In therapy it is advisable to avoid every strong cure in tabetic atrophy, but it is not true that every antisyphilitic treatment or protein therapy must have a bad effect on the course of the optic-nerve disease, as some authors assert. Until now we have no remedy to stop the process. The theory of Lauber and Lobansky cannot be accepted. Dr. Igersheimer said that their procedure has, if at all, only a transitory effect.

Virgil G. Casten,
Recorder.

COLORADO OPHTHALMOLOGICAL SOCIETY

December 16, 1939

Dr. Melville Black, *presiding*

Treatment of carcinoma of the lids

Dr. Edward J. Meister, by invitation, presented an exhibit demonstrating the effects of treatment of carcinoma of the lids by X rays. He pointed out that the eye can be more effectively shielded from X rays than from radium, hence X rays are considerably safer to use. While most of the lesions of the lids are basal-cell carcinoma, it is necessary to give somewhat more than a minimal destructive dose in the case that a mixed-cell tumor might be present.

Accommodation in a man of 80 years

Dr. Edward Jackson reported that he had recently examined a man 80 years of age who had retained from 1.5 to 2 diopters of accommodation. Dr. Jackson stated that active accommodation may persist much longer than is commonly thought. He has a dozen patients over 60 with from 1 to 1.5 diopters of accommodation and can recall at least two patients of 80 years with one-half diopter. Apparently Helmholtz's theory of accommodation is satisfactory for the infant eye, but after the age of 30 years the nucleus is too firm to undergo satisfactory molding.

Retinal detachment

Dr. J. Leonard Swigert read a paper on the etiology and pathology of retinal detachment. Detachment is rare before the age of 20 years and gradually increases in frequency as age advances.

Sixty-six percent of the cases occur after the age of 40 years. The condition is approximately twice as common in males as in females. Dr. Swigert pointed out some of the wide variations in statistics obtained by different observers.

Discussion. Dr. John C. Long reported seven cases of anterior disinsertion of the retina that had been successfully operated upon by Dr. Ralph W. Danielson and himself. Only three of the patients had myopia, the others having emmetropic or mildly hyperopic eyes. The detachment followed definite trauma in three instances. Considerable improvement in the visual field followed surgery in all cases. The central vision obtained was as follows: 0.1, 0.8, 1.0, 0.4, 0.4, 0.3, and 3/60.

Dr. Ralph Danielson discussed the treatment and prognosis of retinal detachment. He stressed the importance of very careful preoperative study, including visual fields, ophthalmoscopic drawing, and localization of tears. A discussion with the patient and family of aims and probable results is of considerable importance in view of the fact that even a highly successful surgical result may not restore good central vision.

John C. Long,
Secretary.

COLLEGE OF PHYSICIANS OF PHILADELPHIA

SECTION ON OPHTHALMOLOGY

December 21, 1939

DR. ALEXANDER G. FEWELL, *chairman*

TRANSCRANIAL EXTIRPATION OF A FIBROHEMANGIOMA OF THE ORBIT—REPORT OF CASE

DR. BENJAMIN SOUDERS briefly discussed the clinical features of hemangioma of the orbit. He enumerated operative procedures for the removal of orbital tumors and mentioned some of the advantages of a transcranial orbital approach. He reported a case of fibrohemangioma, removal of which was facilitated by a transfrontal craniotomy.

THE EXTRAOCULAR MUSCLES IN MYASTHENIA GRAVIS AND HYPERTHYROIDISM

DR. MELVIN W. THORNER said the extraocular palsies in myasthenia gravis are so commonly present that the ophthalmologist sees many of these patients first. The chief characteristics of these paralyses are that they change from one muscle to another frequently and that the weaknesses are greatly lessened by the administration of prostigmine. The most generally accepted explanation of myasthenia weakness is that there is an area of deficient conduction of the nerve impulse at the myoneural junction. This (according to Dale) is partly dependent upon the presence of acetylcholine at the myoneural junction. According to this hypothesis the myasthenic patient either destroys his acetylcholine too rapidly or produces it in insufficient quantity. More recent work would indicate that the myoneural junction is not the sole site of pathophysiology in myasthenia gravis. The pathological findings in myasthenia gravis are not prominent. There are intramuscular collections of lymphocytes (the lymphorrhages) which are found most frequently in the extraocular muscles. Also it should be noted that 50 percent of the autopsied cases show thymic abnormalities, chiefly neoplasms.

In the case of hyperthyroidism, a totally different situation exists. Approximately 50 percent of patients with hyperthyroidism may present some degree of exophthalmos, although the milder degrees may require the use of an exophthalmometer for detection. While the ultimate cause of exophthalmos is unknown, the proximate cause is hypertrophy of the orbital contents. In many cases

this hypertrophy and mechanical distortion is so great that ocular movements are impeded. The explanations for exophthalmos that have been advanced are: (1) the exophthalmos is caused by excessive thyroid secretion, and (2) the exophthalmos is caused by sympathetic stimulation of Mueller's muscle. However, experimental evidence has shown that exophthalmos may be produced in thyroidectomized and sympathectomized animals by the administration of thyrotropic hormone. The existence of true isolated extraocular palsies in hyperthyroidism is rare, occurring in one of 300 cases. In the pathology of hyperthyroidism there are fairly constant lymphorrhages in the extraocular muscles and thymus-gland hypertrophies, the latter not usually with neoplasm formation.

The concomitant association of these two conditions in the same patient is an interesting phenomenon. When it occurs, as it rarely does, a type of "see-saw" balance is established between the two: When the hyperthyroidism is most marked, the myasthenic symptoms are least marked. It was possible in one such case (Arch. Int. Med., 1939, v. 64, p. 330) to establish a therapeutic balance for a time.

This presentation has been an attempt to show the difference in mechanism by which ocular movement is impaired in myasthenia gravis and hyperthyroidism. In addition, the mutual antagonism of the conditions, when they coexist, has been noted.

Discussion. Dr. I. S. Tassman asked Dr. Thorner his explanation for the various muscles being affected in this condition at different times, and one muscle recovering when another becomes affected, only to become again involved at a later stage.

It might also be of interest to ask whether the effect of prostigmine in myasthenia gravis is produced by its action on the choline esterase, whereby it would serve to interfere with the esterase in its role as antagonist to the parasympathetic activity of acetylcholine.

Dr. H. Maxwell Langdon said there is no doubt that persons having myasthenia gravis show more marked changes toward the end of the day than they do in the early morning. He had seen about four cases of this condition, all of them having not only the changes in the ocular muscular activity but also in the other parts of the body much less active toward the end of the day.

The word "paralysis" in relation to these cases is in his opinion not accurate, although he supposes it is the best word we have to describe their condition. The myasthenia term suggesting a fatigue of muscles is descriptive and, of course, they do go on to actual loss of muscular function.

Dr. Thorner in conclusion stated that Dr. Tassman's question, as he probably suspected, is not easy to answer. In myasthenia, each muscle appears to have a certain limited rate of energy production. When this is used up, as, for example, in an external rectus muscle, it may no longer function until it has had a recovery period. During this recovery period, the internal rectus may become exhausted and inactive. In this manner, a plausible explanation for the rotation of extraocular-muscle weaknesses may be built up.

While prostigmine is postulated either to inhibit the abnormally great destruction of acetylcholine (by cholinesterases) or to stimulate its production, neither of these two hypotheses is definitely proved. The blood esterase findings have not as yet been shown sufficient agreement among investigators to afford a basis for a pedantic and categorical statement.

The above-mentioned facts concerning the limited-energy production in muscles

might serve to explain why the myasthenic patient is weaker at night. The day's endeavors would be very likely to have used up most of the available energy supply so that at night the weaknesses are most marked. This clinical fact was noted by Arb and Goldflam, and most of the clinicians following them, but this rule, as most others, has its exceptions. Some patients are worse in the morning than at night.

He quite agreed with Dr. Langdon's abhorence of the word "paralysis." Most generally, the term would broadly include any one of many conditions which have in common the inability voluntarily to perform a movement. The unsatisfactory word in such a definition is the word "voluntary," which could lead to a host of esoteric and philosophic arguments. All this is, of course, pointless when the mechanism underlying a "paralysis" is known.

A CLINICAL EVALUATION OF DARK-ADAPTATION TESTS

DR. FRANCIS H. ADLER and DR. ROBB MCDONALD presented a paper on this subject.

Discussion. Dr. Robb McDonald said there is one point about the taking of these tests that he would like to mention. In those graphs in which the cone function is well marked and the rod-cone transition time occurred at about 10 minutes, the light adaptation was 4,900 millilamberts for three minutes and the test was run for 40 minutes. In the shorter graphs where the cone function is not marked, the light adaptation was 490 millilamberts for three minutes.

Last year in discussing a paper on dark adaptation here he stated that in a few cases of suspected vitamin-A deficiency he had been able to lower the threshold rather precipitously by the administration of carotene intramuscularly. He had since not been able to repeat this nor has he been able to reduce the threshold rapidly by the administration of larger amounts of vitamin A.

Dr. Jacob B. Feldman stated that he had passed the 4,000 mark in dark-adaptation studies quite some time ago. The sharp break in the cone threshold described by Hecht can be likened to the instance of two individuals running at the same speed for several hundred feet. One is a myocardial patient, the other normal.

If the pulse in each case is taken every few seconds after the running, the pulse of the myocardial patient will possibly be 160, 158, 155, 150, then drop to 110, 108, and continue at 106. The pulse of the normal person will be 120, 118, 115, then drop to 82, 72, and continue at 72. The running of the two individuals may be compared with the light adaptation of the two eyes; the reading of the pulse, to the dark adaptation. The break in the pulse, 158 to 110 in one case and 115 to 82 in the other, is comparable to the final cone threshold of dark adaptation.

Derby and Waite have called attention to this previously. Hecht explained this as a final threshold.

His readings are in millilamberts (M. L.) and the curves plotted are in photons at the suggestion of Dr. Alfred Cowan, who felt that since this is an eye test, the photons give the units of light in units of retinal illumination.

He believes that dark adaptation should be considered more in the light of a test of liver function than of avitaminosis A.

His experiences have been most peculiar in a case of pregnancy complicated by night blindness. A total of 25,000 units of vitamin A by 10 injections cured the night blindness, but did not prevent a very bad cold from setting in.

A total of 1,400,000 units of vitamin A (28 injections) for a cirrhosis did not bring down the pathologic dark adapta-

tion to normal. Of 60 cases of renal calculi, 90 percent showed a pathologic dark adaptation. A great many improved clinically, but not in a single case did the renal calculi dissolve.

Dr. Alfred Cowan said he was particularly interested in the findings of Dr. Adler and Dr. McDonald with regard to myopia. It seems unreasonable to consider that in typical myopia the light sense should be reduced. Typical myopia, in his opinion, is nothing but a form of ametropia, and in the presence of no other condition the dark adaptation should be no higher than in hypermetropia. He should like to know what Dr. Adler thinks of this and whether or not he can offer an explanation; or is it possible that in their cases the myopia might merely have been a coincidence?

Dr. Adler in conclusion said deficient dark adaptation might be expected in cases of myopia where degenerative changes were present in the retina and choroid but they found a few myopic patients with definite night blindness in whom no such changes were present. Dr. Hecht has also noted this in a number of such cases he examined. He considered these to be cases of congenital night blindness. He can only say that as yet we do not know how to explain either occurrence.

A CLINICIAN'S EXPERIENCE WITH SULFANILAMIDE

DR. BURTON CHANCE read a paper on this subject, which was published in this Journal (August, 1940).

Warren S. Reese,
Clerk.

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THE CHANGE OF EDITORSHIP

For 55 years there has been an American Journal of Ophthalmology. Initiated at a time when ophthalmic discoveries were coming with breath-taking speed, it has appeared with unbroken regularity on the desks of many generations of ophthalmologists, of the clinic, or of the laboratory.

During that time it has ably fulfilled its function, which is that of serving its readers and contributors. It has capably maintained a balance between the clinic and research with, as a policy, more emphasis on the former, so that it has earned the honorable reputation of being the "Clinician's Journal." Within its covers have appeared numerous original articles, all of value, many exceptionally noteworthy and a few announcing major discoveries that have revolutionized diagnosis or therapy; with benefit alike to patient and physician. For more than 20 years it has presented the most up-to-date abstracts in the English language of the world's ophthalmic literature. New ideas and the interchange of opinions have always been hailed with immediate attention. It has served as a means of recording, in permanent form, the many profitable reports of society proceedings, including the more modest ones, which otherwise would have been lost. It has attempted to publish current news of interest to its readers. By its precise honesty it has safeguarded its subscribers

against pernicious and unscrupulous advertising. It has courteously welcomed new and young contributors to its pages in the belief that whatever is of ophthalmic worth should be granted a hearing. It has survived two wars and, God willing, will survive another, more dreadful than the last.

It is, therefore, with much humility and some trepidation that the new editor approaches his task. The fear would have been greater had he not the knowledge that the experienced consulting editors, Drs. Jackson and Crisp, the retiring editor, Dr. Post, and members of the editorial board would continue their wholehearted countenance and mature counsel. The new editor's confidence is likewise bolstered by the fact that the competent, wise, and loyal manuscript editor, Miss Emma S. Buss, will remain.

During the retiring editor's regime, the Journal has flourished as never before. In his proficient guiding hands its wholesome influence has spread in ever-widening circles. It is sincerely regretted that onerous pressure of work together with increased teaching responsibilities has forced him to give up that which had become so intimately a part of his life, and to which he was devoted. We shall still have, however, the privilege of printing in these columns an occasional editorial from his pen. In the past 10 years we have learned to trust and to lean on the rational common-sense discussions and advice contained in them.

While there is a change in editorship, the policies of the Journal will continue as outlined in the second paragraph. There will be no sweeping innovations, and anything that will promote the welfare of ophthalmology will receive a welcome.

It is hoped that the transfer of the office to Cincinnati will proceed smoothly, although it is inevitable that delays and mistakes will occur. The new editor, confident in the hope that he can rely on the backing of old and new subscribers, craves indulgence and eagerly solicits the staunch support of the ophthalmic profession, especially in these times when it begins to appear as if "the grasshopper shall be a burden . . . because man goeth to his long home."

Derrick Vail.

A PAN-AMERICAN BOARD OF OPHTHALMOLOGY

The experience of 26 years has shown the enormous advantages that have accrued to American ophthalmology from the development and work of the American Board of Ophthalmology. The advances in graduate training and the generally high standards throughout the country are in marked contrast to those of two short decades ago.

The European system of training ophthalmologists has been definitely supplanted by the system that has of necessity been developed in the United States. In Continental Europe a few men were trained by long-continued assistantships in the teaching clinics. Some of these went into private practice, but the majority remained in academic circles. The practical ophthalmologists, upon whom fell the burden of caring for the needs of the population, received their training from the various short courses that were given in a small number of ophthalmologic centers or from attendance as observers in the larger ophthalmologic clinics. This system resulted in the development of a comparatively few highly trained men and the inadequate preparation of the larger group.

In the United States the endeavor has been to train a larger number of men to care for the needs of the population, and to train those men adequately by two- or three-year residencies in well-conducted ophthalmologic institutions. The

small number of academic men still have the opportunity for the five-year training in a limited number of universities. As a result of this policy, which has been fostered by the American Board of Ophthalmology, the general standards of ophthalmologic practice, particularly in relation to private practice of ophthalmology, are far higher than they ever were on the Continent.

The system now prevalent in the United States is being duplicated in Latin America insofar as conditions permit, but there are lacking the stimulation and the unobtrusive guidance of the board of ophthalmology. I wonder whether or not the activities of the board could not be made Pan-American. In view of the closer relationship between the ophthalmologists of Latin America and the United States, would there not be a better understanding and a greater communion of scientific spirit if there were the common interest in a Pan-American board of ophthalmology?

It would seem wise for the board to approach the teachers of Latin America to determine whether such an idea would be acceptable. If so, it should not be difficult to enlist the sympathy and active coöperation of such teachers throughout the republics of Latin America and develop a board of ophthalmology, either as part of the American Board or a separate board acting in coöperation with the American Board. If this idea meets with favor, the Pan-American Congress of Ophthalmology will be more than happy to lend its facilities toward such a rapprochement. Harry S. Gradle.

METASTATIC CARCINOMA OF THE IRIS—DIAGNOSIS

The paper on this subject by Asbury and Vail, published in the last volume of this Journal (p. 402), shows that this condition is very rare. But an additional case reported by Stallard, in the November number of the British Journal of Ophthalmology, emphasizes its practical importance, and that its nature may be overlooked. Metastases of carcinoma to the uveal tract are not very rare, but the great majority of them occur in the choroid, or ciliary body, and do not involve the iris. Among these cases the choroidal lesion has been the first-recognized evidence of malignant disease. This was true in two cases seen by the writer. In Stallard's case of carcinoma of the iris there was a history of syphilis and a positive Wassermann reaction that led to the primary diagnosis of gumma. But X-ray examination of the chest revealed a shadow from the right bronchus, and post-mortem examination showed this to be the seat of the primary carcinoma. There were metastatic deposits in the brain, liver, spleen, and peritoneum.

The eye, fully examined, furnishes exact and positive evidence of nutritional, metabolic, vascular, and metastatic changes that may be going on in other parts of the body. The ophthalmoscope and the biomicroscope, with tests of vision, color perception, and visual field, can furnish extremely valuable evidence for the diagnosis of general disease. This evidence can be rendered useful only by the ophthalmologist. The surgeon, who only uses the ophthalmoscope to look for choked disc, or the neurologist, who only looks at the retinal vessels when he finds high blood pressure, is not prepared to judge the significance of what he sees. The general practitioner, seeing a swelling or adhesion of the iris, would naturally think first of the more common cause of such lesions. The service of the specialist to the general practitioner and the public depends on the breadth of his knowledge, and his interest in general medicine and surgery.

Edward Jackson.

FAMILIAL MACULAR DYSTROPHIES

Notwithstanding the ignorant dogmatism of a great European fanatic, the world of today knows no such thing as a pure or unmixed race. In the words of a recent writer (Cole, chapter twelve of "The nature of the world and man"), "Intermixture has taken place as the result of invasions, slavery, trade, and other causes, until in some regions there has been a thorough fusion through many generations. In such a group there are frequent reversions of type; individual variations also produce constant deviations, so that we find great extremes within each race and subrace."

Such intermixture must have taken place not merely during the centuries of man's historical development, but through tens of thousands of generations of primitive man in his evolution from lower forms; for complete disappearance of any human group, without partial absorption into that which replaced it, is likely to have been the exception rather than the rule.

In clinical experience, we cannot always be certain whether the appearance of so-called degenerative disturbances is peculiar to the individual, or reverts to similar defects in a forgotten ancestor. Accurate family histories are usually difficult to obtain. If the schoolboy of today is often unable to answer a question as to the nature of his father's occupation, it is hardly surprising that many physical qualities of the parents remain unknown to the offspring.

Galton was one of the first to study the amazing resemblances between identical twins, even when they had lived most of their lives in widely varying environments. Vogt has demonstrated in such twins the identical development, at corresponding ages, of ocular changes such as we are often disposed to attribute to external influences. Closer study of successive generations may greatly increase the number of disorders which are to be regarded as familial rather than individual characteristics.

Among the ocular defects for which we can offer the patient no remedy are various forms of central retinal degeneration. It is not surprising to find such defects in the eyes of an octogenarian or even a septuagenarian. We readily attribute the lesions to the natural process of senile decay in the circulatory apparatus. Yet in many septuagenarians and octogenarians we discover no such organic disturbance of the central visual area, and the difference depends in all probability upon familial tendencies rather than upon presence or absence of individual causes of vascular breakdown. The same may be true even as regards the more exceptional occurrence of central chorioretinal degeneration in middle life.

As in deaf-mutism or albinism, or even in congenital cataract, it may happen that the disorder lay dormant in both parents, acting, that is, as a recessive, yet when these two individuals mated they conferred upon their offspring the unfortunate tendency to development of the organic defect.

With an abundance of excellent illustrations, Sorsby (British Journal of Ophthalmology, 1940, volume 34, page 469) has assembled and classified from the literature, and from the experience of himself and professional colleagues, many familial examples of macular dystrophy as well as cases which seem genetically related to this general group of lesions.

The conditions reviewed include a wide variety of ophthalmoscopic manifestations, ranging from simple fine mottling of the macula, through Doyne's choroiditis (massive formation of white dots in the paracentral area, with slight tendency to formation of pigment and ultimate development of atrophic areas) to pseudo-

exudative phenomena, hole formation, extensive perimacular involvement, and so-called inverse retinitis pigmentosa (anatomic and visual changes involving the central region as contrasted with the equatorial changes of classic retinitis pigmentosa).

The designation "macular dystrophy" is convenient for the general grouping of these widely varying conditions. The dystrophy is obviously not always macular, although the more striking effects are of course found when the anatomic center of retinal activity is involved. In a number of cases, including a family group recorded by Best and illustrated in Sorsby's article, the lesion was outside the macula, the vision being excellent; while in other cases the preservation of central vision demonstrates that the fovea is spared in spite of apparently general involvement of the macular region.

Because of the clear presence of dominant inheritance, Sorsby finds good reason to include in his survey definitely congenital disorders associated with gross functional anomalies like day-blindness and complete color-blindness, as well as a wide range of lesions appearing at periods varying from infancy to old age.

He argues that there is no logical objection to regarding antenatal lesions as belonging to the continuous series of "postnatal" affections. Embryologically speaking, birth is merely a single incident in the process of development. We may think of death, in the form of involution, as beginning before birth; and pathologic changes may be involutional in nature no matter when they occur. Thus, an essential vascular hypertension occurring in the twenties may be just as strictly involutional, and may rest just as firmly upon a familial basis, as a similar disorder appearing in the sixties.

Although practically complete absence of histologic material renders discussion of the minor anatomy of macular dystrophies purely conjectural, Sorsby suggests that the available clinical evidence points to degeneration of the cones.

The sort of information presented by Sorsby emphasizes the sense of therapeutic helplessness which most of us must have experienced in dealing with central retinal degenerations. There is little we can do for the usual case of senile or presenile macular dystrophy, or for some analogous conditions included within the scope of Sorsby's monograph.

Yet in many of these cases, just as in many cases of so-called incipient cataract, the faith of physician and patient alike in a multitude of therapeutic measures is encouraged on the one hand by looseness of observation and records, and on the other hand by slight or often imaginary variations in visual acuity during the slow course of the disorder.

W. H. Crisp.

SO-CALLED COMPENSATED GLAUCOMA

Recently some writers have been using the terms "compensated" and "incompensated" glaucoma, instead of congestive and noncongestive, to convey the idea that glaucoma was balanced or inactive in the first case and had signs of activity and progress in the second.

The terms "compensated" and "incompensated," proposed by Dr. Ehrlich,* are not in my opinion accurate and have not a physiologic or pathologic base to support them.

Compensated, as applied in general medicine to heart diseases, for instance, means that nature, trying to overcome the dangerous systemic results of a disturbed function, has succeeded in balanc-

* Elschnig. Glaukomeinteilungen. Arch. f. Ophth., 1928, v. 120, p. 94.

ing it by use of a force, usually mechanic, which opposes the perverted action of the diseased organ and brings it to a more or less perfect functional equilibrium. That is, the organ has come to an adjustment which more or less restores its normal functioning. In heart diseases, for instance in mitral insufficiency, the right ventricle hypertrophies and the compensating effect of this hypertrophy arrests the mischief for a time.

Nothing of the sort occurs in glaucoma. So-called compensated glaucoma is usually a simple or noncongestive type of the disease which, at the moment of the observation, does not show signs of activity; but that does not mean that there is a force or mechanism compensating the effect of the glaucomatous process and arresting it for a time; simply, that the disease is either dormant or inactive.

The only compensation that nature provides to overcome high intraocular tension is an increase in the arterial pressure of the retinal vessels, with the purpose of forcing the amount of blood necessary for the nutrition of the retina and nerve fibers into the arteries, which are compressed and flattened by the increased intraocular pressure and offer more resistance to the flow of blood. This increase in the arterial blood pressure has been shown by Bailliart and others to be present to a greater or less degree in all cases of hypertension, but it does not compensate the disease in the sense of maintaining the intraocular fluid in equilibrium and the functions of the eye on a normal plane.

It is a proved fact that, by compression, high intraocular pressure produces an atrophy of the optic-nerve fibers, so that even when the intraocular circulation is balanced, the optic-nerve fibers continue to deteriorate, as is shown by progressive changes in the field of vision. These occur even in cases in which the intraocular pressure appears normal or has little variation.

As long as the optic nerve suffers an increased pressure, the eye is not, and cannot be, in a functional equilibrium, nor can we call the disease "compensated."

We do not know the essential cause of glaucoma. We do not know why in some cases, miotics seem to stop simple glaucoma for some time, and why later it becomes progressive. It is certain, however, that in very few cases is the process entirely arrested.

It will be more accurate and avoid many misunderstandings to say that primary glaucoma is *inactive* or *arrested* at the time of observation, or has become *active* and *progressive* if the disease goes on.

Manuel Uribe Troncoso.

THE DINNER FOR DR. POST

At a meeting of the directors of the American Journal of Ophthalmology, held in Cleveland, October 10, 1940, Dr. Lawrence T. Post presented his resignation as editor on the grounds of pressure of other duties. The resignation was accepted with regret, and Dr. Derrick Vail was elected to assume the editorship as of January 1, 1941. Subsequently Dr. Jackson was asked by the directors to draw up an expression of appreciation on their behalf of the service rendered by Dr. Post to the Journal for the past 17 years, almost 10 of them as editor. As a further token of appreciation they decided to present to Dr. Post a watch inscribed with the words: LAWRENCE TYLER POST, 1940, FOR HIGH SERVICE TO OPHTHALMOLOGY.

The occasion for the presentation was a dinner sponsored by the Saint Louis

Ophthalmic Society in honor of its distinguished member, the retiring editor of the American Journal of Ophthalmology, on November 27, 1940, at the University Club, to which the members of the Ophthalmic Section of the Saint Louis Medical Society were also invited. About 70 members, guests, and friends sat down, the out-of-town guests including Dr. Benedict of Rochester, Minnesota, Dr. Gradle of Chicago, Dr. Wherry of Omaha, and Dr. Vail of Cincinnati. Dr. John F. Hardesty, the president of the Saint Louis Ophthalmic Society, in his role as toastmaster, read aloud messages and telegrams of appreciation and felicitation to Dr. Post from various ophthalmologists and from the school heads, then introduced the speakers. Dr. Benedict reviewed the history of the Journal from its inception in 1862; Dr. Gradle spoke on the present Journal, humorously indicating various improvements that might be made; in the same vein Dr. Vail described how it felt to be appointed editor; and Dr. Wherry gave a warm personal tribute to Dr. Post as a man and friend, each, in turn, touching on the retiring editor's work. Then Dr. Woodruff briefly spoke of the action taken by the directors and on their behalf presented the expression of appreciation and the watch.

In response, Dr. Post modestly acknowledged the tributes as accruing not to the person but rather to the position held and as such graciously accepted them. He generously mentioned by name all who had helped in the work and their contributions in the various departments, and spoke feelingly of the pleasure and privileges inherent in the office of editor.

His many friends wish him continued enjoyment of his work and bespeak his continued interest in the Journal.

Frederick E. Woodruff.

BOOK NOTICES

QUIMICOTERAPIA DO TRACOMA

(Chemotherapy of trachoma). By Octacilio Lopes, Clinica St. Luzia Catanduva, Brazil. Paper bound, 250 pages. Published by Impresa Grafica da "Revista dos Tribunais," São Paulo, Brazil.

The chemotherapy of trachoma has a long history, if we go back to Hippocrates and the use of copper salts in Egypt. But only now has it achieved a great success in the use of sulfanilamide and related compounds. This has been announced from Johns Hopkins University as well as from Egypt and China, and now from the tropics of Brazil. This book is divided into three chapters: I. The present status of chemotherapy. II. Chemotherapy in trachoma. III. Observations. Outline abstract reports of 231 cases.

A bibliography is appended, giving the titles of 273 related articles that have been consulted in the preparation of this book. There is also a list of 37 scientific publications of the author referring to a variety of conditions that interest the ophthalmologist.

The cases reported in abstract are not all cases of trachoma. Some are given as trachoma, doubtful. There are also included a few cases of hypopyon-keratitis, acute conjunctivitis, phlyctenular keratitis, trachoma complicated by maxillary sinusitis, traumatic rupture of the cornea, and traumatic keratitis, all of which have been treated with sulfanilamide and allied drugs, with striking success in the cases of keratitis. All the usual complications of trachoma are here represented, including entropion, and also dacryorhinocystitis. The bibliography of 273 titles gives but one reference to an article published before 1937. For ophthalmologists who can read Portuguese

this book will be very valuable, and it cannot be ignored in any review of current literature.

Edward Jackson.

TUBERCULINOTHÉRAPIE DANS LES NÉVRALGIES FACIALES IDIOPATHIQUES ET CERTAINES AFFECTIONS ESSENTIELLES. (Tuberculin therapy in idiopathic, facial neuralgias and certain essential affections.) By Dr. Carlos Charlin C. Talleres de la Editorial Nascimento, Santiago de Chile, 1940. Paper covers 336 pages, 33 figures, of which 20 are photographs, 12 charts, and one drawing. Price not stated.

The material making up this volume has been published in part in several communications appearing intermittently during the past few years in the Annales d'Oculistiques. The earlier papers are devoted to a discussion of ophthalmic disease associated on the one hand with the nasal nerve, and on the other with Meckel's ganglion. The author distinguishes the two affections by anatomical enervation, sympotomatically by the presence of ocular lesions, congestion, superficial pain of the external nose, and facial eruption, all characteristic of the disturbances in the nasal nerve. In either case, however, immediate relief is obtained by application of powdered cocaine-adrenalin.

The greater part of the monograph, however, is concerned with the tuberculin treatment of both ocular and generalized conditions of assumedly tuberculous or obscure etiology. The tuberculin used in treatment was either Koch's old tuberculin, or the methyl alcohol extract originally introduced by Nègre and Boquet, the choice of the preparation depending upon the tolerance of the patient. The treatment is prolonged and consists of intracutaneous injections of infinitely small doses. The reviewer sees little new in the therapy or the administration, and feels that acknowledgment to preceding workers would have been an important and graceful touch.

In any case, 40 patients with a diagnosis of essential neuralgia of the eye were treated with tuberculin, apparently with benefit to most. In this group tuberculin skin tests gave reactions in 28 cases, doubtful reactions in 5, no reaction in 5, and in 2 skin tests were not done. This forms the basis of the argument for the tuberculous origin of this manifestation.

This form of treatment was subsequently carried over to a large variety of clinical conditions in which ocular lesions were also demonstrable. Thus patients with cardiovascular disease, rheumatoid disease, migraine, and others, received equal alleviation from their symptoms. In tuberculous infection of the eye, iritis, iridosclerokeratitis, and myalgia, the author also reports success. Nonocular forms of tuberculosis are also reported as benefited by tuberculin therapy. Indeed, the general results obtained were so encouraging that the author recommends that "in the presence of lesions, both of unknown etiology and resistant to treatment, there is only one method of eliminating infection: the experimental, tuberculin treatment. One sees the presence of the same clinical problem offered by occult syphilis, namely occult tuberculosis."

L. A. Julianelle.

OBITUARY

SIR WILFRED THOMASON GRENFELL
1865-1940

The modern ophthalmologist still remembers he is a member of the medical

profession, and is still interested in the great leaders in medicine and surgery. Thus he hears with regret and sorrow of their passing from the sphere of active life. Grenfell, founder of the Labrador Medical Mission, died October 9, 1940, at Charlotte, Vermont. Licensed by the Royal College of Physicians of London and member of the Royal College of Surgeons of England, he turned away from his opportunities of metropolitan practice to serve the dwellers on the rock-bound, ice-bound coast of Labrador. He sought and had the assistance of competent American ophthalmologists. In his declining years he lived in Vermont, where he could be near to those he had spent his active life in helping. Britain had honored herself in recognizing his human service by conferring on Dr. Grenfell her title of nobility.

ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP
ASSISTED BY DR. GEORGE A. FILMER

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. General methods of diagnosis
2. Therapeutics and operations
3. Physiologic optics, refraction, and color vision
4. Ocular movements
5. Conjunctiva
6. Cornea and sclera
7. Uveal tract, sympathetic disease, and aqueous humor
8. Glaucoma and ocular tension
9. Crystalline lens
10. Retina and vitreous
11. Optic nerve and toxic amblyopias
12. Visual tracts and centers
13. Eyeball and orbit
14. Eyelids and lacrimal apparatus
15. Tumors
16. Injuries
17. Systemic diseases and parasites
18. Hygiene, sociology, education, and history
19. Anatomy, embryology, and comparative ophthalmology

3

PHYSIOLOGIC OPTICS, REFRACTION, AND COLOR VISION

Elliot, A. J. **Ophthalmoplegic migraine.** Canadian Med. Assoc. Jour., 1940, v. 43, Sept., p. 242. (See Section 4, Ocular movements.)

Jackson, Edward. **Practical skiascopy.** Amer. Jour. Ophth., 1940, v. 23, Nov., pp. 1239-1242.

Keyser, G. W. **Congenital anisochromatopsia.** Acta Ophth., 1940, v. 18, pt. 1, p. 51.

By this term the author designates a difference in the color perception of the two eyes. He believes that it is commonly overlooked because the two eyes are usually tested together. In the case he reports, both eyes were abnormal, but the anomaly quotient of Kries was different in the two eyes.

Ray K. Daily.

Lijo Pavia, J. **Synthetic testicular hormones in the treatment of progressive myopia.** Rev. Oto-Neuro-Oft., 1939, v. 14, July, p. 161.

Citing the opinion of Giannini, Bussola, and Mawas that some of the essential changes in myopia occur as a result of changes in the pigment epithelium of the retina, the author advocates the use of testosterone in the therapy of progressive myopia. The rationale for this procedure is based upon the interrelationship of the pars intermedia of the hypophysis and the sex glands, the former playing an important role in epithelial-pigmentation phenomena. A single case in which testosterone (0.005 grs.) was given intramuscularly every four days is cited by the author. The changes occurring in the so-called Fuchs's spot at the fovea are illustrated by photographs of the fundus. Edward P. Burch.

Malone, J. Y. **Progressive myopia, keratoconus, and keratoglobus.** Trans. Sec. on Ophth., Amer. Med. Assoc., 1939, 90th mtg., p. 44.

The author studied 2,300 cases of refraction of which 574 (or 25 percent) were myopic. Of these, 104 (or 22 per-

cent) were of the progressive type, including four cases of keratoconus and two of keratoglobus. In the treatment the author used 1 to 1000 epinephrine instilled into the conjunctival sac twice daily. Full refractive correction was prescribed for constant use. No changes were made in the patients' habits, nor were restrictions put on the use of the eyes. Only 1.7 percent of the progressive cases progressed in spite of the treatment. The author suggests that substitution of the adrenal hormone can conceivably operate to correct endocrine imbalance in the causation of myopia although the factor of hereditary predisposition cannot be denied. (5 case reports, discussion.)

George H. Stine.

Moore, R. F. **Subjective "lightning flashes."** Amer. Jour. Ophth., 1940, v. 23, Nov., pp. 1255-1260.

4

OCULAR MOVEMENTS

Davis, W. T. **Treatment of accommodative convergent squint.** Trans. Amer. Acad. Ophth. and Otolaryng., 1939, 44th mtg., p. 151.

The author finds orthoptics remarkably efficacious in cases of purely accommodative squint. The patient is taught disassociation of accommodation and convergence. (Discussion.)

George H. Stine.

Elliot, A. J. **Ophthalmoplegic migraine.** Canadian Med. Assoc. Jour., 1940, v. 43, Sept., p. 242.

The author describes briefly the onset and course of ophthalmoplegic migraine and the sequelae that may be expected. A case is reported in which the right trochlear nerve was first paralyzed, followed two and one-half years later by involvement of the right oculomotor nerve. In both instances function was regained in one month. Four weeks after the second attack the left oculomotor nerve was paralyzed, and three months later there was still some ptosis and diplopia when looking to the right.

The hypophyseal and vasomotor theories of causation are briefly discussed. The hypophyseal theory presumes the occurrence of transitory swelling of the hypophysis with pressure on the cavernous sinus and nerves connected with it. The vasomotor theory presumes a spasm of cranial arteries following excessive autonomic excitation. The only treatment discussed is use of ergotamine tartrate, 1-mg. tablet twice daily increased to six times daily, or subcutaneous injection of 0.5 mg. twice daily.

Morton Cutler.

5

CONJUNCTIVA

Appelmans, M. **Primary tuberculosis of the conjunctiva.** Bull. Soc. Belge d'Opht., 1940, no. 79, p. 94.

It is noted that in primary tuberculosis the bacillary lesions generally remain confined to the corresponding adeno-lymphatic territory, and are unaccompanied by eczema or phlyctenular keratoconjunctivitis. This affection occurs within the age period of surgical tuberculosis and resembles the latter in its benign course. Lesions of the adenoid layer of the conjunctiva have the same significance as those of the corresponding glands. Both fix the bacilli, prevent their dissemination, and permit the organism to actively immunize itself. (Case report.)

Jerome B. Thomas.

Barnshaw, H. D., and Read, W. T., Jr. **Rhinosporidiosis of the conjunctiva.**

Arch. of Ophth., 1940, v. 24, Aug., pp. 357-361.

A young man aged 17 years presented a quite vascular papillomatous growth arising from the palpebral conjunctiva of the upper border of the tarsal plate when the upper lid was everted. This was excised and histologic study revealed a parasitic infiltration of the conjunctiva, with typical sporangium. This is thought to be the first case reported in the United States. (Bibliography.) J. Hewitt Judd.

Goedbloed, J. **Keratoconjunctivitis punctata superficialis.** Ophthalmologica, 1940, v. 99, May, p. 436. (See Section 6, Cornea and sclera.)

Julianelle, L. A. **Possible relation of the inclusion body of trachoma to pathogenesis.** Proc. Soc. Exper. Biol. and Med., 1940, v. 43, March, p. 507.

To test the infective capacity of conjunctival tissues, material was obtained from different patients with trachoma. Three groups of monkeys were inoculated respectively with conjunctival tissues containing inclusions, tissues lacking inclusions, and pooled tissues some of which were inclusion-bearing and others inclusion-deficient. The greatest number of infections were induced in the first group. In the second group the inclusion-lacking tissues induced the least number of infections. In the third group where the pooled tissues were used, the transmission of disease occupied an almost mathematically halfway position between the two extremes. The percentages were 50, 22, and 38 respectively. The author suggests an actual relation of inclusion to infectivity to the extent that the inclusion represents an agglomeration of virus particles. It is felt that such an opinion requires further elaboration before it can finally be accepted.

F. M. Crage.

Kettler, J. R., and Rutherford, C. W. **Sulphanilamide in old trachoma.** Jour. Indiana State Med. Assoc., 1940, v. 33, May, p. 227.

The authors present statistics from the Indiana Welfare Department showing the efficacy of sulphanilamide in the treatment of trachoma.

Theodore M. Shapira.

Laval, Joseph. **Vaccinia of the eyes.** Arch. of Ophth., 1940, v. 24, Aug., pp. 367-370. (See Section 14, Eyelids and lacrimal apparatus.)

Que, K. L. **The economic value of sulphanilamide in the therapy of trachoma.** Ophthalmologica, 1940, v. 99, May, p. 479.

The average hospital stay of 26 patients with second and third stage trachoma treated with sulphanilamide in 1939 was 17 days. That of 14 patients treated without this drug in 1937 was 35 days. F. Herbert Haessler.

Rambo, V. C. **The use of sulphanilamide in trachoma.** Proc. All-India Ophth. Soc., 1938, v. 6, pp. 193-198.

After discussing the literature on the use of sulphanilamide in trachoma, the author states that he had used it previous to the original American reports. He personally applies the powder to the eyes every two hours during the day, and administers a dose of 1 gram by mouth each evening.

Lawrence G. Dunlap.

Rosenberg, L., and Rosenberg, J. **Multiform exudative erythema (Hebra) with conjunctivitis and stomatitis.** Arch. Derm. and Syph., 1940, v. 41, June, p. 1066.

The authors report a case of multiform exudative erythema with purulent conjunctivitis in an 11-year-old boy. The condition healed completely without complication.

Theodore M. Shapira.

Rubbrecht, R. **Pterygium.** Bull. Soc. Belge d'Opht., 1940, no. 79, p. 38.

A report of two cases. (8 photomicrographs of tissue sections.)

Sie-Boen-Lian. **The relationship between the course of adult gonorrheal conjunctivitis and the vitamin-A content of the blood.** Ophthalmologica, 1940, v. 99, May, p. 496.

In 84 adult patients with gonorrheal conjunctivitis, with and without corneal involvement, the vitamin-A content of the blood was lower in those who suffered corneal complications.

F. Herbert Haessler.

Torres Estrada, A. **Treatment of pterygium.** Jour. Internat. College of Surg., 1940, v. 3, June, p. 219.

The subject of pterygium is reviewed and the treatment discussed in detail. The author excises the pterygium and closes the defect by two vertical flaps, forming an N-shaped wound. The importance of removing any excess of episcleral tissue is stressed.

T. E. Sanders.

Whalman, H. F. **Mucous-membrane grafts in ophthalmic conditions.** Trans. Pacific Coast Oto-Ophth. Soc., 1938, 26th mtg., pp. 32-37.

Whalman recommends that mucous grafts be taken from the mouth to supplement or supplant conjunctival tissue in pterygium, symblepharon, trachoma, recurrent ulcers, and vernal conjunctivitis. He obtains the mucous membrane from the lower lip and has not found it necessary to suture the edges of the wound from which the graft is taken. Lawrence G. Dunlap.

6

CORNEA AND SCLERA

Aten, A. H. **Internal ulcer of the cornea.** Ophthalmologica, 1940, v. 99, May, p. 350.

The author describes the clinical course and histologic preparation of an eye which became the seat of severe inflammation in the course of a septicemia. Opposite a necrotic area in the inflamed iris extensive destruction in the cornea took place from behind.

F. Herbert Haessler.

Baird, M., and Clay, G. E. **The treatment of corneal ulcers, with emphasis on X-ray therapy and the use of vitamins.** Southern Med. Jour., 1940, v. 33, April, pp. 396-402.

In the authors' experience the X ray has been the most valuable single item in the treatment of bacterially infected corneal ulcers. They have not observed any perforation of the cornea in ulcers so treated in the last six years. They recommend the use of 80 to 100 R. (one-fourth erythema dose) of unfiltered X ray given at a distance of 8 inches. This should be repeated from four to six times at intervals of from three to five days. Baird and Clay also believe that avitaminosis plays a greater part than has heretofore been suspected, and that in all breaks in continuity of corneal epithelium a pad should be used. T. E. Sanders.

Blaess, M. J. **Sulphanilamide in the treatment of Mooren's ulcer.** Jour. Michigan State Med. Soc., 1940, v. 39, April, p. 249.

Sulphanilamide given orally until the

blood-sulphanilamide level reached 4.0 mg. per 100 c.c. kept the ulcer from progressing. Theodore M. Shapira.

Boros, Béla. **Vasoneurosis with eye symptoms.** Brit. Jour. Ophth., 1940, v. 24, April, pp. 179-181.

A 32-year-old man suffered repeated transient attacks of inflammation in the right eye only. He was observed in one of the attacks and was found to have swelling of the lids, photophobia, conjunctival and ciliary injection, edema of the cornea, and fullness and throbbing of the blood vessels of the right temple. The patient and two members of his family had migraine, and the patient was also quite neurasthenic. The author regards the case as one of intermittent corneal edema or ophthalmomalacia based on an inherited constitution. (References.)

D. F. Harbridge.

Brown, A. L. **Effect of local typhoid-H antibody concentration on production of corneal ulcers in rabbits.** Arch. of Ophth., 1940, v. 24, July, pp. 38-43.

In an effort to determine the effect of local antibody production in a much higher concentration than could be produced by paracentesis or intravenous injection of antigen, a suspension of typhoid-H antigen was injected into the anterior chambers of rabbit eyes, after which corneal ulcers were produced by injection of a heavy suspension of live staphylococci into both eyes. The results not only indicate that an increased intraocular typhoid-H antibody concentration inhibits the growth of the ulcers but that there is probably an optimum concentration for this inhibition which lies between 1 to 36 and 1 to 60. Concentration above 1 to 120 seems to have a deleterious effect on the ocular tissues. Since a fairly rapid increase in the titer of the blood can be accomplished by intravenous administration of typhoid antigen and an increased titer of the aqueous up to 1 to 36 can be produced by paracentesis within six or seven days, this method is the only one applicable for clinical cases in which antibody therapy is used. J. Hewitt Judd.

Deutman, A. F. **Formolized cornea and keratoplasty in rabbits' eyes.** Ophthalmologica, 1940, v. 99, May, p. 418.

In five normal rabbit eyes penetrating homokeratoplasty was performed. All grafts were made with normal rabbit cornea that had been fixed for one day in 4-percent formaldehyde and washed in running tap water for two days. All took and healed with less reaction than fresh issue. All grafts remained clear after from one to 11 months of observation.

F. Herbert Haessler.

Fine, Max. **Homotransplantation of preserved cornea.** Amer. Jour. Ophth., 1940, v. 23, Oct., pp. 1140-1146.

Goedbloed, J. **Keratoconjunctivitis punctata superficialis.** Ophthalmologica, 1940, v. 99, May, p. 436.

The clinical picture is described. The etiology is unknown and probably not herpetic. F. Herbert Haessler.

Hagedoorn, A. **Keratitis subepithelialis leprosa.** Ophthalmologica, 1940, v. 99, May, p. 440.

The author describes a case of leprosy which was diagnosed by the appearance of the cornea. Characteristic are the small white lesions which are not intraepithelial but slightly deeper.

F. Herbert Haessler.

Howard, W. H. **Corneal transplantation.** Arch. of Ophth., 1940, v. 24, Aug., pp. 238-246.

As a result of experimental work on animals and theoretic comparisons of the operative procedures using twin blades and the keratome, the automatic trephine, and the hand trephine, the author recommends the hand trephine since it embraces the necessary elements toward which the future development of transplantation should be directed, and is more suitable for the needs of the majority of oculists. An improved stabilizing corneal trephine is described and observations relating to operative technique are made, including a description of a simplified cross-suture. J. Hewitt Judd.

Kronfeld, P. C. **A note on the treatment of the sequelae of perforated corneal ulcer.** Amer. Jour. Ophth., 1940, v. 23, Sept., pp. 1014-1018.

Löwenstein, Arnold. **Specific inflammation of the cornea in chickenpox.** Brit. Jour. Ophth., 1940, v. 24, Aug., pp. 391-398.

The clinical picture of corneal infection with chickenpox virus harmonizes with earlier investigations in which the author had found vitiligo iridis after chickenpox. The eye is first inflamed, followed by the skin eruption, the cornea becoming hazy in about ten days. (Figures, bibliography.)

D. F. Harbridge.

MacDonald, A. E. **Recent advances in the care of the insensitive cornea.** Arch. of Ophth., 1940, v. 24, July, pp. 182-186.

The author outlines a practical routine for protection of the insensitive cornea. The Tovell shield of medium-weight cellophane can be shaped so as to fit comfortably against the skin, thus completely occluding the space between the spectacles and the orbital margin. A more accurate test for the sensitivity of the cornea is obtained by using measured silk sutures of varying sizes. J. Hewitt Judd.

Malling, H. **A family with Groenouw's keratitis.** Acta Ophth., 1940, v. 18, pt. 1, p. 58.

A case of nodular keratitis is described in detail. Of 26 examined persons representing three generations of this family, 12 had the disease. All but one presented the same corneal picture of infiltrations of different size and shape arranged in a radiating figure; the picture was somewhat different in the case of a ten-year-old girl. (Illustrations.) Ray K. Daily.

Meyer, K., and Chaffee, E. **Mucopolysaccharide acid of cornea and possible relation to the "spreading factor."** Proc. Soc. Exper. Biol. and Med., 1940, v. 43, March, p. 487.

The nature of the mucopolysaccharide of the cornea has been much debated. The chemical makeup of the substance and the method of obtaining it are given. The investigators doubt whether this polysaccharide is concerned with corneal transparency, since the sclera and substantia propria of the cornea are similar chemically and histologically except for the presence of this polysaccharide in the cornea.

F. M. Crage.

O'Connor, Roderic. **Corneal cautery for conical cornea and corneal astigmatism.** Trans. Pacific Coast Oto-Ophth. Soc., 1938, 26th mtg., pp. 25-31.

O'Connor reports ten cases in which the cornea was cauterized with a radial linear cautery placed at right angles to the greatest corneal curvature and extending from 2 mm. external to the limbus up to the pupillary area. The platinum tip of a Prince cautery was

used at black heat. The treatment was employed for high refractive errors, and there were nine good results and one failure. Of five cases of corneal astigmatism so cauterized two were improved and three were not.

Lawrence G. Dunlap.

Perera, C. A. **Vaccinal disciform keratitis following accidental inoculation of the eyelid.** Arch. of Ophth., 1940, v. 24, Aug., pp. 352-356.

The literature is reviewed and the characteristic features of this rare condition are discussed. A typical case is presented in which a man aged 32 years was accidentally infected from the recent vaccination pustule of his child. It is suggested that the changes in the deep layers of the cornea depend on injury to the corneal endothelium and the entrance of aqueous as well as to direct toxic action of the infective virus.

J. Hewitt Judd.

Rones, Benjamin. **Pathologic conditions of the cornea. 1. Disturbances of the epithelium, endothelium, and Bowman's and Descemet's membranes.** Arch. of Ophth., 1940, v. 24, Aug., pp. 374-395.

The author reviews the pathology of the surface epithelium and endothelium together with the adjacent layers, Bowman's and Descemet's membranes, in the light of the newer knowledge of corneal metabolism and respiration. He discusses the role of these layers in the physiology of the cornea, their histologic structure and general pathologic behavior, pigmentation, atrophy and hyperplasia, dystrophy, degeneration, edema, wounds and repair, and inflammation. The various changes discussed are well illustrated with photomicrographs. J. Hewitt Judd.

Rötth, A. de. **Local action of oils containing vitamin A.** Arch. of Ophth., 1940, v. 24, Aug., pp. 281-291.

The author reviews the literature and reports the results of two series of experiments. In the first, in which oil containing vitamin A and beta carotene was dropped into the eyes of rats suffering from keratomalacia, the results indicate that the oil has a definite systemic, not local, action when applied to the eye. The author is not certain whether the oil is absorbed by the eye or reaches the stomach through the nasal duct. In the second series of experiments it was found that there was no difference in the time necessary for epithelization of the denuded areas in the eyes of animals, not suffering from vitamin-A deficiency, treated with cod-liver oil and those treated with liquid petrolatum. J. Hewitt Judd.

Rychener, R. O., and Kirby, D. B. **Acute hydrops of the cornea complicating keratoconus.** Arch. of Ophth., 1940, v. 24, Aug., pp. 326-343; also Trans. Amer. Acad. Ophth. Otolaryng., 1939, 44th mtg., p. 100.

A review of the literature reveals eight cases previously reported. To these the authors add the case of a man aged 35 years, known to have had keratoconus for nine years, who suddenly developed acute hydrops and keratectasia in the right eye. This slowly cleared after 26 paracenteses and the use of atropine, dionin, and heat. Fibrosis with flattening of the cornea occurred, permitting the wearing of an ordinary glass in place of the contact lens previously used. Two years later a similar attack appeared in the left eye. This was treated by dionin and hot packs only, and healing occurred similarly to that in the right

eye. Experimental hydrops of the cornea was produced in rabbits by posterior keratotomy, and spontaneous clearing of the cornea took place after periods varying from two weeks to two months leaving striate opacities corresponding to the lacerations in Descemet's membrane and similar to those described following resolution of the complication in human eyes with keratoconus. Therefore posterior keratotomy is offered as a rational procedure in eyes affected by keratoconus in which visual acuity is reduced to a low degree or in which the protrusion of the cornea is of such a high degree that exposure of the cornea and its subsequent complications endanger the integrity of the eyeball. In the discussion five additional cases are reported. (Bibliography.) J. Hewitt Judd.

Schreuder, M. **On anisotropism in the elasticity of corneal tissue.** Ophthalmologica, 1940, v. 99, May, p. 490.

The cornea exhibits optical anisotropism. The long axis of the index-ellipses of double refraction is vertical, and the short is horizontal. The bovine cornea was measured and found to be more elastic vertically. This fact may account for the development of corneal astigmatism in glaucoma.

F. Herbert Haessler.

Terry, T. L., and Chisholm, J. F., Jr. **Studies on keratoconus relative to the effect of prolonged application of pressure.** Amer. Jour. Ophth., 1940, v. 23, Oct., pp. 1089-1100.

Thomas, J. W. T. **Corneal transplantation.** Rev. Oto-Neuro-Oft., 1939, v. 14, Oct., p. 239.

A description of the well-known technique of corneal transplantation after the method of the author.

Edward P. Burch.

Vail, Derrick. **Corneal involvement in congenital ichthyosis (keratoderma).** Arch. of Ophth., 1940, v. 24, July, pp. 215-220.

A review of the literature discloses two cases of ichthyosis corneae similar in every respect to the case reported here in which a nine-year-old boy with congenital ichthyosis had multiple corneal nodules, which histologically resembled those seen in Salzmann's corneal dystrophy. Removal of most of the nodules and large doses of vitamins (especially vitamin D) favorably influenced the severe photophobia and also the cutaneous condition which had persisted since infancy. Several authors have previously pointed out the similarity between this condition and other corneal dystrophies, especially the Salzmann type, but the entire subject awaits further investigation. The histologic changes in the atrophied nodules are described and illustrated with photomicrographs. J. Hewitt Judd.

Van Waveren, W. F. J. **Amotio retinae attending scleritis and its possible relations with Harada's disease.** Ophthalmologica, 1940, v. 99, May, p. 543. (See Section 10, Retina and vitreous.)

7

UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Battignani, Agostino. **Tuberculous panophthalmitis.** Boll. d'Ocul. 1939, v. 18, Nov., pp. 895-905.

The right eye of a boy of four years, who was affected by tuberculosis of the lungs, developed sudden pain and blindness from glaucoma. Sections of the enucleated eye revealed that a mass had developed from the iris and the adjacent ciliary body, being separated from the posterior section of the eye-

ball by the lenticulo-zonular diaphragm. Microscopically this mass was found to contain giant and epithelioid cells separated by zones of lymphocytic infiltration. The writer believes that the tubercle bacilli reached the anterior uveal tract by the long posterior ciliary arteries and that the new-formed mass might have been the exponent of an intense local reaction in an allergic subject. (Bibliography, 5 figures.)

M. Lombardo.

Bolettieri, Daniele. **A peculiar malformation of the anterior segment of the eye characterized by congenital cataract and pigmented digitations.** Boll. d'Ocul., 1939, v. 18, Sept., pp. 729-742. (See Section 9, Crystalline lens.)

Coppez, L. **Detachment of the choroid following operation for detachment of the retina.** Bull. Soc. Belge d'Opht., 1940, no. 79, p. 154. (See Section 10, Retina and vitreous.)

Coppez, J. H. **Favorable evolution of a case of sympathetic ophthalmia.** Bull. Soc. Belge d'Opht., 1940, no. 79, p. 20.

A patient 25 years old was wounded in the left eye and developed sympathetic ophthalmia in the right eye two months later, at which time the left eye was enucleated. The author states that medication with sodium salicylate combined with atophan had a marked effect upon the pain and in clearing the anterior chamber. Three months after the beginning of treatment the vision had risen from 1/10 to 5/10.

Jerome B. Thomas.

Davson, H., and Quilliam, J. P. **The permeability of the blood-aqueous humor barrier to potassium, sodium, and chloride in the surviving eye.** Jour. of Physiology, 1940, v. 98, May, p. 141.

This article attempts to settle a part of the disputed question as to whether the aqueous is a dialysate or a secretion. The results show that the membrane separating the eye fluids from the blood is neither specifically impermeable to cations, as claimed by Gaedertz and Wittgenstein, nor unidirectionally permeable, as claimed by Robertson. Experiments comparing the behavior of living and poisoned eyes indicate that the membrane does not secrete potassium and probably not sodium or chloride. (9 references.)

Ralph W. Danielson.

Duke-Elder, S., Quilliam, J. C., and Davson, H. **Some observations on the present position of our knowledge of the intraocular fluid.** Brit. Jour. Ophth., 1940, v. 24, Sept., pp. 421-444.

This report is presented somewhat prematurely as the investigations are not yet completed, but because of interruptions due to war and the revival of the old hypothesis of ciliary secretion, the authors' findings are published now for what immediate value they may have. There is no proof that the fluid is a secretion, the claims advanced for the existence of irreciprocal permeability between blood and aqueous being qualitatively and quantitatively unfounded. It is further stated that results of experiments show no difference in general behavior between the living and the dead eye, which argues against the existence of secretory activity. Chemical analyses and permeability studies are presented. (Tables, references.)

D. F. Harbridge.

Friedman, Benjamin. **Choroideremia.** Arch. of Ophth., 1940, v. 23, June, pp. 1285-1287.

A man aged 45 years presented the

typical fundus picture of choroideremia. Vasodilator therapy did not produce any objective improvement, although there seemed to be slight subjective improvement. The author briefly discusses the nature and possible causation of this condition. The appearance of the fundus is shown in a color plate.

J. Hewitt Judd.

Gardner, W. J., and Shively, F. L., Jr. **Adie's syndrome.** Cleveland Clinic Quarterly, 1940, v. 7, July, p. 203.

Adie's syndrome is characterized by two features: a tonic pupil and absent tendon reflexes. This condition has been recognized by neurologists for many years, but there has never been an adequate explanation of the etiology and pathogenesis. Cases may be either complete or incomplete depending on whether they have only one or both features. The important thing is not to confuse the condition with the Argyll Robertson pupil. An illuminating and complete table shows the differential diagnosis between the two conditions. Four case reports and other interesting discussions are given. Every possibility must be considered in an attempt to reach a diagnosis for an abnormal pupillary reaction. A diagnosis of Adie's Syndrome is made largely by exclusion after every other possibility has been considered in an attempt to find the etiology for such an abnormal pupil. The cause is unknown. There are no sequelae. The syndrome is more frequent in women. Adie's syndrome simulates tabes dorsalis, but it is not due to syphilis. (7 references.)

Ralph W. Danielson.

Guy, Loren. **Passage of horse serum from the blood stream into the aqueous humor of normal and immunized animals.** Amer. Jour. Ophth., 1940, v. 23, Nov., pp. 1209-1215.

Halbertsma, K. T. A. **Presence of histamine in the human aqueous.** Ophthalmologica, 1940, v. 99, May, p. 443. (See Section 8, Glaucoma and ocular tension.)

Irvine, Rodman. **Sympathetic ophthalmia.** Arch. of Ophth., 1940, v. 24, July, pp. 149-167.

This report is based on study of the histories of 37 cases in which the diagnosis was proved by pathologic examination, and 26 cases in which it was not proved but in which the clinical course was typical of specific uveitis. In this series there was no instance of sympathetic ophthalmia developing without perforation of the globe. The clinical findings are analyzed and tabulated. The author concludes that if enucleation is to prevent the development of sympathetic uveitis, it must be done before two weeks have elapsed from the time of injury. Once sympathetic uveitis has developed enucleation of the exciting eye has no effort on the course of the disease, and this eye should be retained if potentially useful, as it may eventually be the better eye. From the available data there is no indication that the exciting eye acts as a focus of infection "spilling over" into the sympathizing eye. Considering the frequency of occurrence of sympathetic ophthalmia, attempts to save severely damaged eyes, especially if the lens is injured, are not justified if the fellow eye is normal. Also the possibility of sympathetic uveitis must be considered when operation is contemplated on eyes nearly blind from any cause. The progression of symptoms in the course of the disease may be of diagnostic importance since the exciting eye is always irritable at the onset of symptoms in the sympathizing eye and keratic precipi-

tates are nearly always present in the sympathizing eye and make their appearance in this eye before they appear in the exciting eye. The wounds exciting sympathetic uveitis characteristically show incarcerated lens substance or uveal tissue. This fact and the incidence of the condition after various types of operations suggest that iris-inclusion operations are more likely to cause complications with sympathetic uveitis than trephine operations, and that repair of perforating injuries should include freeing the wound of incarcerated substance and firmly uniting the tunica fibrosa. A method to accomplish this end is described.

J. Hewitt Judd.

Kindt, Peter. **Three cases of nodular iritis.** Acta Ophth., 1940, v. 18, pt. 1, p. 38.

A brief review of the literature and a detailed report of three cases. The author agrees with Coppez and Dujard that many atypical cases of tuberculous iritis are in reality cases of Boeck's sarcoid. Ray K. Daily.

Legras, A. M., and Wolters, D. H. F. **Ophthalmologic complications in a case of Weil's disease typus canicola.** Ophthalmologica, 1940, v. 99, May, p. 469.

A patient with canicola fever (symptoms of severe influenza with jaundice), presumably acquired the disease from her dog which had drunk from a ditch abounding in rats. The ocular complications were inflammatory infiltrations in the choroid and iris.

F. Herbert Haessler.

Magitot, A., and Dubois-Poulsen, A. **Harada's disease.** Ann. d'Ocul., 1940, v. 177, April, pp. 145-160.

Harada's disease is a symptom complex, the essential factors of which are: bilateral uveitis, subsequent retinal detachment, systemic and neurologic signs, whitening of the hair, and vitiligo. This disease is usually found in the orient, but occasionally cases are found in Europe and in the Americas. Vogt described a similar condition in 1906. The general and neurologic manifestations usually consist of deafness, headache, vomiting, vertigo, and insomnia. In some instances increased cerebrospinal pressure and lymphocytosis have been noted. Meningeal irritation and low-grade fever may also appear. The etiologic agent has never been definitely determined. Some authors liken the disease to sympathetic ophthalmia, some to tuberculosis. Harada succeeded in recovering from the spinal fluid a filter-passing agent which could be carried through successive animal inoculations both in the eye and in the brain. These animals (rabbits) developed some of the manifestations of the human disease. (3 case reports.) John M. McLean.

Rochat, G. F., Jr. **A case of congenital melanosis of the eye.** Ophthalmologica, 1940, v. 99, May, p. 481.

In an 18-year-old girl with normally functioning eyes the entire surface of the iris was studded with melanotic masses. The patient was the only red-haired member of a family of brunettes.

F. Herbert Haessler.

Scheie, H. G. **Site of disturbance in Adie's syndrome.** Arch. of Ophth., 1940, v. 24, Aug., pp. 225-237.

Six cases of Adie's syndrome are reported in which the affected pupils all contracted after instillation of mecholyl, suggesting that the lesion affects the parasympathetic supply to the iris at the ciliary ganglion or peripheral to it. This denervation would have to be

partial, since the sphincter muscle does respond to physostigmine salicylate, which acts only in the presence of intact nerve-endings, and also because reaction in convergence and to other pupillary reflexes is present though tonic. The importance of distinguishing this syndrome from tabes dorsalis with Argyll Robertson pupils is stressed.

J. Hewitt Judd.

Taylor, E. M. **Recurrent iritis.** Trans. Pacific Coast Oto-Ophth. Soc., 1938, 26th mtg., pp. 116-123.

A patient who had had a low-grade iritis of the left eye returned a year later with a similar condition of the right eye. No focus of infection was found, although there was a history of a Neisserian infection three years previous to the first attack. The usual foreign-protein therapy and local and general treatment were used, in addition to sulphanilamide in the fourth attack. Two months later a recurrence was treated with intravenous typhoid, and then a complete iridectomy was performed which had prevented recurrence to the time of this report.

Lawrence G. Dunlap.

Van Canneyt, J. **Microphthalmos of one eye, coloboma of the other (second case in the same family).** Bull. Soc. Belge d'Opht., 1940, no. 79, p. 100. (See Section 13, Eyeball and orbit.)

Van Lint, A. **Congenital miosis.** Bull. Soc. Belge d'Opht., 1940, no. 79, p. 24.

Report of a case of double miosis in a youth of 19 years, the pupils having a diameter of about 1 mm. In the absence of other eye defects the case was diagnosed as congenital miosis due to absence of the dilator muscles.

Jerome B. Thomas.

Van Lint, A. **Iritis during treatment of a case of chronic blennorrhea with sulphamide and vaccine.** Bull. Soc. Belge d'Opht., 1940, no. 79, p. 150.

In a case of chronic gonorrheal ophthalmia treated with sulphamide and antigonococcic vaccine, an acute iritis developed, followed after a few days by complete cataract. In treating gonorrheal ocular complications one should not employ sulphamide and shock (vaccines, milk injections) simultaneously.

Jerome B. Thomas.

8

GLAUCOMA AND OCULAR TENSION

Pereira, R. F. **Inverted cyclodialysis of Blaskovics.** Arch. de Oft. de Buenos Aires, 1939, v. 14, July, p. 547.

A young woman developed increased intraocular tension after a Safar operation for retinal detachment. A classical Heine cyclodialysis on the lower temporal sector of the globe was attempted, but due to incontrollable bleeding from cicatricial tissue, the inverted cyclodialysis of Blaskovics was performed. The conjunctiva was incised transversely above, 8 mm. from the corneal limbus. The scleral opening was made immediately in front of the tendon insertion and lengthwise to the superior rectus muscle. This afforded a more ample cyclodialysis without incarceration of the iris root. The traction force of the superior rectus during normal ocular movements tends to keep the lips of the scleral wound in apposition during the healing process. Postoperative tension remained within normal limits.

Plinio Montalván.

Scardaccione, Mario. **Clinical and experimental contribution to the knowledge of papilledema in ocular hypotony.** Boll. d'Ocul., 1939, v. 19, Nov.,

pp. 855-875. (See Section 11, Optic nerve and toxic amblyopias.)

9

CRYSTALLINE LENS

Bakker, A. **Comparative investigations on the reaction of the lens and cornea to infrared rays.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 180-187. (See Section 16, Injuries.)

Muhlmann, V., Ré, B. V., and Lachman, R. **The treatment of incipient senile cataract with ascorbic acid.** Arch. de Oft. de Buenos Aires, 1939, v. 14, July, p. 552.

The different methods of medical treatment of cataract are reviewed briefly. The chemical properties and the pharmacodynamic and physiologic actions of ascorbic acid are reported in detail. The importance of ascorbic acid in the metabolism of the lens is discussed. Based on these studies cases of cataract of different etiology, clinical types, and stages of evolution were treated with vitamin C for a period of two years. The group comprised sixty patients selected at random: incipient, immature, and mature senile cataracts of the nuclear, cortical, and capsular types; cataracts secondary to iridocyclitis, choroiditis, and glaucoma. From the general physical standpoint, the group included diabetic, hypertensive, and renal patients. Vitamin C was the only treatment given. Careful slitlamp studies and visual-acuity tests were made as a basis to evaluate the results of the treatment.

Vitamin C was administered hypodermically in some cases, but the more effective intravenous route was used exclusively in the majority of the patients. The treatment consisted of 20 intravenous injections given on alternate days. The first ten injections were each of 50 mg. of vitamin C and the dose was increased to 100 mg. for the last ten injections. Another course was given after a period of rest of approximately two months, and the treatment continued in this manner throughout the two-year experimental study.

All patients improved in their general physical condition. Vision was improved in 51.32 percent, remained unchanged in 38.93 percent, and continued to diminish in 9.73 percent. The most favorable results were obtained in the incipient stages, where a definite improvement was observed in 95 percent of the cases. When vision was less than 0.5 the chances of improvement were poor. The treatment has no contraindications. Plinio Montalván.

Ostmann. **The analysis of the healing process in atypical gout-cataract.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 156-179.

The author, self-treated by balneotherapy at Neuenahr, describes the gradual clearing of his own lens opacities. He first discusses the necessity for observation of the cataracts by both patient and physician, and explains the three factors which he considers necessary for the healing: chemical, physicochemical, and biological. He describes the subjective (entoptic) and objective changes as the cataracts healed, over a period of 20 years. He explains the process chemically and biologically, but gives no report as to measurement of visual acuity or slitlamp findings.

C. A. Perera and U. Ollendorff.

Thometz, H. M. **Some new instruments and technique in ophthalmic surgery.** Illinois Med. Jour., 1940, v. 78, Aug., p. 151.

The author argues against the time-honored and widely accepted upward

incision of the cornea in cataract extractions for the following reasons: (1) that upward iridectomy does not guarantee against glare and color-fringe disturbance; (2) that cosmetic deformity is of minor importance as compared to assuredness of good functional result; (3) that when the eye is turned down, especially during convalescence, the main part of the upper-lid pressure is exerted upon the sclera above the wound and little or none upon the loosened cornea below, so that separation of the wound margins is produced; (4) unhandy working position for the surgeon in operating upon the left eye; (5) risk of stabbing or cutting the lids in deep-set eyes and the difficulty of getting sufficient conjunctiva for an adequate flap or bridge; (6) excessive drag upon and distortion of the eyeball in completing corneal section; (7) greater danger of vitreous loss in the presence of iridic adhesions. It is recommended that the incision be made laterally. The author claims that pressure of both lid margins transversely across the center of the wound in this form of operation is a better safeguard against prolapse. He believes that the operation is easier to execute and favors the use of monocular occlusion beside definitely shortening hospitalization. The incision is made with a keratome or bistoury designed by himself and the wound is enlarged with scissors. A conjunctival elevator is described. Ralph W. Danielson.

10

RETINA AND VITREOUS

Biró, Imre. **Cholesterin crystals on the fundus.** Szemészet, 1940, v. 3, June, p. 20.

In the right fundus of a diabetic patient cholesterin crystals protruding into the vitreous were visible. Moreover, a striate hemorrhage below the macula and two smaller hemorrhagic spots toward the periphery were noted. The origin of the cholesterin crystals is discussed by the author. It is conceivable that when the blood was absorbed the cholesterin of the blood, which in the present case amounted to 196 mg. per 100 c.c., remained and became crystallized. It is further possible that the cholesterin crystals were formed in the degenerated retinal foci, since cholesterin crystals are a sign of degeneration. R. Grunfeld.

Blumenthal, C. J. **Simple detachment of the retina.** South African Med. Jour., 1940, v. 14, Aug., 24, p. 315.

The author reports 68 cases of simple detachment of the retina. The cases are classified into three groups: (1) detachment from dialyses, believed due to an abnormality in closure of the fetal cleft; (2) lapel tears, occurring most often in myopic eyes and believed due to two areas of adhesions, one between the vitreous and retina and one between the retina and retinal pigment epithelium; and (3) cases where detachment is the result of single small holes, usually associated with degenerated retina and vitreous. The author reports 22 cases in group 1 of which 100 percent were cured, 15 cases in group 2 of which 68 percent were cured, and 28 cases in group 3 of which 45 percent were cured.

The intrinsic factors involved in the production of the detachments are discussed in considerable detail. An original method of diathermy puncture with a very small needle combined with a special suction technique is described. Anesthesia by injection to eliminate clouding effect of cocaine or pontocaine on the cornea is described.

Morton Cutler.

Cusick, P. L. **Effect of anoxia and of high concentration of oxygen on the retinal vessels.** Proc. Staff Meetings Mayo Clinic, 1940, v. 15, Aug. 7, p. 500.

The author used two methods: (1) Morgan graticule, and (2) prism displacement for measuring changes in the caliber of retinal vessels. In anoxemia at simulated altitudes of 18,000 to 21,000 feet, dilatation of the vessels varied between 10 and 20 percent, being more marked in the veins. With high concentrations of oxygen, diminution in caliber varied between 10.5 and 37.7 percent, being usually more marked in the veins. The probable relationship between similar effects on retinal and cerebral circulation is discussed. The effect on angioscotomata in the two conditions is suggested as being due to change in the caliber of the vessels. Experiments suggest an autoregulatory mechanism for control of retinal circulation.

Morton Cutler.

Jervis, G. A. **Amaurotic family idiocy.** Amer. Jour. Dis. Children, 1940, v. 60, July, p. 88.

The author describes a case of late infantile amaurotic idiocy with megalocephaly. Pathologic studies are included. Theodore M. Shapira.

Lijo Pavia, J. **Senile macular exudative retinitis.** Rev. Oto-Neuro-Oft., 1939, v. 14, Aug., p. 191.

After briefly outlining the historic background of senile exudative macular degeneration, the author describes its evolution from the first stage, characterized by yellowish spots at the macula similar to drusen, through the hyperplastic second stage, to the final stage of atrophy; and states that it must be differentiated from Coats's exudative retinitis, Coats's neuroretinitis or gliosis of the retina, and malignant tumor at the posterior pole. He is more inclined to the theory of vitamin and hormone deficiency than to the conventional belief of circulatory deficiency of the macular region secondary to vascular changes. Three personal observations which are illustrated by fundus photographs are given by the author. Edward P. Burch.

Murphy, E. S. **Fundus in hypertension.** Trans. Pacific Coast Oto-Ophth. Soc., 1938, 26th mtg., pp. 108-115.

The author divides clinical hypertension into two types: the systolic type, from which the patient recovers when the cause of the hypertension is removed; and the diastolic type, which is permanent so far as the changes in the fundus are concerned, and from which the patient does not recover. He adds a list of conditions which produce a clinical rise in blood pressure. The retinal findings in hypertension are of great prognostic value, and it is pointed out that the vascular changes are chiefly confined to the vessels of the retina rather than those of the choroid. The various changes are listed and two case reports are included.

Lawrence G. Dunlap.

Roesler, H., Gibson, G., and Hussey, R. **A correlation study between retinal vascular changes, electrocardiographic alterations, and radiological heart size in essential hypertension.** Annals Internal Med., 1940, v. 13, April, p. 1814.

The authors studied eighty cases. In 88.8 percent they found retinal vascular changes of the sclerotic hypertensive type. Electrocardiographic changes were present in 68.8 percent, slight to moderate enlargement of the heart in

50.8 percent, and marked enlargement of the heart in 27.1 percent.

Theodore M. Shapira.

Seidel, E. **The development of the clinical picture of thrombosis of the central vein of the retina.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 151-155.

The author was fortunate enough to observe a patient with thrombosis of the central vein from its very onset to the microscopic study of the enucleated eyeball. The patient was a 45-year-old woman who had suffered from facial lupus and severe migraine. Her hands and feet were always cold, an indication of vasomotor instability. The patient complained of sudden diminution of vision of her right eye, but examination of the fundus of this eye showed no abnormality. Twenty minutes later vision of the affected eye had been reduced to one tenth of normal, and the background revealed narrowed arteries, full veins, small hemorrhages adjacent to the veins, and edema around the nerve head extending to the macula which had a cherry-red fovea. Secondary glaucoma developed two months later, and the eye was removed because of severe pain. Four photomicrographs show the appearance of the optic nerve, with thrombosis of the central vein and hyalin degeneration of the arteries and veins on the papilla. The author believes that the thrombosis resulted from arterial spasm with subsequent reduction in venous pressure, stagnation of the venous blood stream, and collapse of the venous walls.

Charles A. Perera.

Sorsby, Arnold. **The dystrophies of the macula.** Brit. Jour. Ophth., 1940, v. 24, Oct., pp. 469-534.

Eight familial groups of macular dystrophy are presented. The author classifies clear-cut types into three groups: (1) central choroidal sclerosis, (2) angioid streaks, and (3) central retinal dystrophy. Experience does not bear out the postulations of Behr that a rigid classification of the macular dystrophies has a chronological basis involving distinct age groups. There is a full presentation of familial incidences. (Photomicrographs, tables, references; appendix by Hans Grueneberg.)

D. F. Harbridge.

Wagener, H. P. **The nature and significance of the retinal lesions associated with hypertensive diseases.** Trans. Amer. Acad. of Ophth. and Otolaryng., 1939, 44th mtg., p. 54.

Ophthalmoscopic changes in patients with elevated blood pressure are essentially demonstrations of disturbed physiology of the arterioles, and the arteriolar lesions are always primarily of a functional nature. Histologically demonstrable lesions in the arterioles are also a late feature of the disorder and may be absent at necropsy, even in the presence of retinitis. Arteriolar sclerosis can be demonstrated definitely to be a part of diffuse sclerosis throughout the body. On the basis of present knowledge, the retinitis which occurs in association with elevation of blood pressure can be explained logically only as a manifestation of some form of decompensation of the retinal circulation. At present no definite etiologic relationship can be established between retinitis and any histologically demonstrable lesion in the kidney. If the kidneys have any direct influence in the development of retinitis of this type it must be through elaboration of a hypothetic effective substance. (One table, 7 figures, bibliography.)

George H. Stine.

11

OPTIC NERVE AND TOXIC AMBLYOPIAS

Boshoff, P. H., and Rethmeier, B. J. **Roentgenologic examination of the optic nerve.** Ophthalmologica, 1940, v. 99, May, p. 367.

By injection of a contrast medium into the orbit, it is possible to demonstrate roentgenologically the optic nerve and tumors of this structure. The authors selected per-abrodil, an iodine compound ($ICH_2 SO_3 Na$) which is so stable that it is unaffected by nitric acid and silver nitrate. It is non-toxic, gives good contrast, is rapidly resorbed from the tissues, and is excreted. It does cause a burning pain and sometimes thirst, headache, and nausea. In five patients it was possible to photograph the length and diameter of the optic nerve. F. Herbert Haessler.

Carroll, F. D. **Retrobulbar neuritis; observations on one hundred cases.** Arch. of Ophth., 1940, v. 24, July, pp. 44-54.

This report is based on the study of one hundred consecutive cases observed by the author. The differential diagnosis, especially from brain tumor and tobacco-alcohol amblyopia, is reviewed and the etiology and treatment of retrobulbar neuritis are discussed. The author points out that retrobulbar neuritis is due to a large number of different etiologic agents and each case should be studied until the true etiology is determined. In this series the causative factors seemed to be multiple sclerosis, 37 percent; Leber's disease, 9 percent; encephalomyelitis, 8 percent; arachnoiditis, 3 percent; vascular disease, 3 percent; sinusitis, 2 percent; syphilis, 2 percent; spinal anesthesia, 1 percent; neuromyelitis optica, 1 percent; and etiology unknown, 34 percent. If the etiologic agent is known, treatment should be directed toward its elimination, but if it is unknown, treatment is of questionable value. In multiple sclerosis, certain conditions predisposing to recurrence should be avoided. J. Hewitt Judd.

Levitt, J. M., and Blonstein, M. **Toxic amblyopia resulting from sodium diphenyl hydantoinate.** New York State Jour. Med., 1940, v. 40, Oct. 15, p. 1538.

A case is reported of a 27-year-old male epileptic, who, after taking 61 tablets (0.1 gm. each) of sodium diphenyl hydantoinate (Dilantin), developed a marked case of bilateral toxic amblyopia. Full vision was promptly recovered upon withdrawal of the drug. In addition to discontinuing the use of the drug, treatment consisted of oral administration of thiamin chloride and cevitamic acid, and three intramuscular injections of 0.1 gm. each of acetylcholine solution. (18 references.)
Ralph W. Danielson.

Reese, A. B. **Relation of drusen of the optic nerve to tuberous sclerosis.** Arch. of Ophth., 1940, v. 24, July, pp. 187-205.

Cases of drusen reported in the literature and all the cases observed at the Institute of Ophthalmology for the past seven years have been analyzed and the findings, together with the description of more important manifestations of tuberous sclerosis, are reported. The findings in this study indicate that drusen of the optic nerve are a feature of the congenital development anomaly known as tuberous sclerosis. They may appear as a part of the fully developed protean disease but more frequently are seen as one of

its many clinical variants or abortion forms. If this is correct, drusen of the optic nerve assume new significance as a familial developmental defect which in the patient, in his progenitors, in siblings, or in offspring is frequently associated with serious involvement of the central nervous system and, rarely, with renal and cardiac lesions. Furthermore, in view of the frequency with which drusen are encountered coincidentally in pathologic specimens, it may be assumed that their incidence, in an inextensive form, is considerably greater than is generally believed, and it is reasonable to suppose that similar changes may occur in the brain far more frequently than is generally recognized. (Bibliography, discussion.)

J. Hewitt Judd.

Scardaccione, Mario. **Clinical and experimental contribution to the knowledge of papilledema in ocular hypotony.** Boll. d'Ocul., 1939, v. 19, Nov., pp. 855-875.

In a boy of 16 years who had sustained a severe blow on his left eye some time before, there was found a slight iridodialysis, marked hypotony, papilledema of 3 D., and loss of 50 percent of vision. Ten months later the tension was 12 mm. (Schiötz) and the papilledema had almost subsided. In order to explain the causative mechanism of the above condition, the writer produced hypotony in rabbits by perforating the globes from the limbus to the equator. A few hours after the perforation enlargement of the retinal blood vessels was manifest and within 24 hours marked edema of the disc. In another series of experiments the skulls of rabbits were trephined and the dura opened so as to evacuate cerebrospinal fluid. No change in the size of the retinal vessels was noticed, but after perforation of the eyeballs edema of the papilla manifested itself. The writer concludes that the production of papilledema is not related to either intracranial or intraocular tension, but that papilledema in hypotony depends exclusively on the lack of a governing force which, in normal conditions, secures the normal course of intraocular fluids. (Bibliography, 3 figures.)

M. Lombardo.

Van der Hoeve, J. **Diagnosis of suprasellar tumors.** Ophthalmologica, 1940, v. 99, May, p. 258.

The author briefly reports four cases of suprasellar tumor to illustrate the importance of several clinical manifestations in the diagnosis, including the appearance of choked disc in an atrophic nerve head or in one in which the papillomacular bundle is atrophic. In Van der Hoeve's patient, the roof of the optic foramen was eroded or destroyed, and the author emphasizes the importance of roentgenograms of this structure. F. Herbert Haessler.

12

VISUAL TRACTS AND CENTERS

Igersheimer, Joseph. **General hypertension and peripheral optic pathways.** Amer. Jour. Ophth., 1940, v. 23, Nov., pp. 1243-1254; also Trans. Amer. Acad. Ophth. and Otolaryng., 1939, 44th mtg., p. 89.

Rochat, G. F. **Aneurysm of the internal carotid with calcification.** Ophthalmologica, 1940, v. 99, May, p. 265.

A patient aged 47 years had had vague unexplained ocular symptoms 12 years before. Now, because of extensive calcification in its walls, an aneurysm of the internal carotid artery was demonstrable radiographically

without the injection of a contrast substance. F. Herbert Haessler.

Tatár, József. **Contributions to the symptomatology of angiospasm of the visual cortex.** Szemészet, 1940, v. 3, June, p. 9.

A physician received a trauma on the occiput from a fall on ice. He did not lose consciousness but vision was reduced to counting fingers. In the temporal visual fields he saw waves of black and gray in motion, and experienced metamorphopsia and macropsia. Vision gradually improved, and after 45 minutes became normal. The author believes that the symptoms were caused by spastic vasoconstriction in the neighborhood of the area striata.

R. Grunfield.

13

EYEBALL AND ORBIT

Jensen, V. A. **Malignant exophthalmos after thyroidectomy.** Acta Ophth., 1940, v. 18, pt. 1, p. 1.

A review of the literature and a report of four typical cases. (Illustrations.) Ray K. Daily.

Keiner, G. B. J. **Cholesterin deposits in the eye.** Ophthalmologica, 1940, v. 99, May, p. 456.

The author presents a description of three cases of cholesterin deposits in the eye and a thorough discussion of ocular lipoidosis. As a basis for a comparison of the three lipoidoses (Niemann-Pick, Gaucher, and Schüller-Christian-Hand) he points out that bulbar cholesterinosis might be a symptom of the Schüller-Christian-Hand type. He discusses possible means of crystallization in primary and secondary fatty degeneration. The importance of the reticuloendothelial system in cholesterol deposits is emphasized.

F. Herbert Haessler.

Schoute, G. J. **The phenomenon of Einthoven and the length of the living eye.** Ophthalmologica, 1940, v. 99, May, p. 282.

By the use of red and blue letters on a black background, it can be demonstrated that the axial length of the eye is proportionate to the apparent difference of distance between two objects of different colors.

F. Herbert Haessler.

Stenbeck, A. **A case of scleroderma with ocular involvement.** Acta Ophth., 1940, v. 18, pt. 1, p. 76.

Only three cases with ocular involvement have been reported in the literature and none of these was autopsied. In the author's patient, a woman 66 years old, the disease set in with swelling of the right lid, and proceeded to exophthalmos, chemosis, restricted motion, and induration of the lids. The induration extended downward until it involved the entire region of the neck. At autopsy the fatty tissue of the orbit was found converted into connective-tissue bands which fettered the orbital muscles and nerves. Microscopically the newly-formed connective tissue contained cellular bodies taking the fibrin stain; they were thought to be rests of collagenous fibrils which had undergone degeneration. (Illustrations.) Ray K. Daily.

Thier, P. F. X. **Individually molded prothesis.** Ophthalmologica, 1940, v. 99, May, p. 500.

For patients who want to wear a prothesis over a blind eye, the author recommends one the posterior surface of which has the characteristics of an

individually molded contact glass made after the principle of Dallas. The anterior surface is like the usual artificial eye. F. Herbert Haessler.

Waardenburg, P. J. **Dysostosis multiplex (Hurler) and its eye symptoms.** Ophthalmologica, 1940, v. 99, May, p. 307.

The author describes two new cases of gargoylism. A congenital, general opacity of the cornea, of different intensity in the two eyes, is pathognomonic and an expression of a dystrophy with little tendency to progress. It rarely leads to nystagmus. Biomicroscopically the corneal epithelium and endothelium are intact and there are numerous linear and macular opacities of different sizes at various depths in the parenchyma. The pupil is often small and difficult to dilate. The diffraction of light in the cornea may prevent inspection of the deeper tissues. Blindness does not follow. The anomaly is rare and must occasionally be differentiated from infantile glaucoma.

Waardenburg's patient showed relaxed thickened conjunctivae, small pupils difficult to dilate, increased opalescence of the lens, ataxic movements, swollen lids, protrusion of the eyeballs in shallow orbits, and large protruding ears placed very low. The symptoms are described in detail, and the future will show which manifestations are essential parts of the syndrome. Inheritance is probably recessive.

F. Herbert Haessler.

14

EYELIDS AND LACRIMAL APPARATUS

Balacco, Franco. **The importance of suturing the sac and nasal mucous membrane in dacryocystorhinostomy.** Boll. d'Ocul., 1939, v. 18, Nov., pp. 876-880.

A description of the writer's technique with special regard to the suture.

M. Lombardo.

Brodsky, I., and Waddy, G. **Cryptophthalmos or ablepharia.** Med. Jour. Australia, 1940, v. 1, June 29, p. 894.

This article discusses the terminology, anatomy, coexistent abnormalities, and the literature of the subject. A case is reported of a child born in February, 1940, in Sidney, Australia, with bilateral cryptophthalmos. An interesting feature was an abnormal external genitalia deformation.

Ralph W. Danielson.

Elder, A. T. **Chronic blepharitis in children: treatment with aniline dye compound.** Brit. Med. Jour., 1940, Aug. 10, p. 185.

The author presents 44 cases of chronic blepharitis treated with an aniline-dye compound consisting of gentian violet 0.25 percent and brilliant green 0.5 percent in an ointment base. Cases were classified as squamous and ulcerative. Thirty-seven of the 44 cases were of the squamous type and all became symptom-free after eight weeks treatment of twice daily applications. The remaining seven cases were of the ulcerative type. One of these responded to daily treatment with hydrogen peroxide and gentian violet. The remaining six failed to return for treatment as advised. The author believes that success with the ulcerative type depends upon their being hospitalized for treatment. No definite correlation could be found between blepharitis and seborrhea, nutritional disorders, or visual defects. Morton Cutler.

Keyser, G. W. **An unusual anomaly of the superior lacrimal canaliculus in a young girl.** Acta Ophth., 1940, v. 18, pt. 1, p. 55.

The author reports the case of a young girl with an absence of the lower lacrimal puncta. The right superior punctum was represented by a depression. A fissure in the left superior canaliculus converted it into an open canal, separated from the lacrimal sac by an atresia. Ray K. Daily.

Laval, Joseph. **Vaccinia of the eyes.** Arch. of Ophth., 1940, v. 24, Aug., pp. 367-370.

Two cases of vaccinia of the eyes due to auto-inoculation are reported. In one of the cases the margins of the lids were primarily involved; in the other, the conjunctiva. The patients in both cases had been vaccinated against smallpox on the upper part of the left arm and both had involvement of the right eye. Both patients were treated with sulphanilamide with prompt relief of symptoms and without any complications or sequelae, but apparently sulphanilamide does not shorten the usual course sufficiently to warrant drawing any conclusions about it in these cases. J. Hewitt Judd.

Lieto Vollaro, A.de. **A simple and rapid operative procedure for the surgical treatment of senile and paralytic ectropion.** Boll. d'Ocul., 1939, v. 18, Oct., pp. 769-780.

An incision is made in the conjunctiva of the lower lid a few millimeters below the margin. The membrane is then dissected from the tarsus down to the fornix. At the temporal side of the lid a triangular flap, base up and including the skin muscle and tarsus, is cut with curved scissors, the resulting apex being at the right side of the lid. The base of the flap must have a width proportionate to the defect. The sides of the resulting wound are sutured with silk or catgut, including the fascia tarso-orbitalis. Details and results of the operation are shown in 12 figures. M. Lombardo.

Stallard, H. B. **A case of chronic granuloma of the lacrimal sac.** Brit. Jour. Ophth., 1940, v. 24, Sept., pp. 457-459.

The accidental retention of a silver style for 33 years brought on chronic granuloma of the right lacrimal sac in the case presented. The presence of this foreign body explained the hard swelling revealed in the orbit and the brownish-black conjunctival discharge which was believed to indicate a malignant melanoma. Pathologic findings indicated no malignancy. (Photograph.) D. F. Harbridge.

Stallard, H. B. **Boeck's sarcoidosis of the lacrimal gland.** Brit. Jour. Ophth., 1940, v. 24, Sept., pp. 451-457.

The characteristics of the disease are described. (Case report, photomicrograph, references.)

D. F. Harbridge.

15
TUMORS

Balding, L. G. **Recurrent papillomata of the conjunctiva.** Jour. Kansas Med. Soc., 1940, v. 41, Aug., p. 344.

A 72-year-old colored female ten or twelve years previously had noticed a little red dot in the upper medial quadrant of the bulbar conjunctiva. This had grown slowly and had been excised seven years previously, and again four years previously. The author removed the growth a third time. The histologic diagnosis was papilloma. In a discus-

sion of the literature it was brought out that although these growths are nearly always benign, cases have been reported where malignancy has developed. (6 references.)

Ralph W. Danielson.

Evans, W. H. **Tumor of the lacrimal caruncle.** Arch. of Ophth., 1940, v. 24, July, pp. 83-106.

The author briefly presents a case of melanotic tumor of the lacrimal caruncle and an analysis of a series of two hundred cases of tumor of the lacrimal caruncle collected from the files of ophthalmologists throughout the country. While these lesions are of rare occurrence they are more frequent than previous reports would indicate. Although papilloma is the most common single diagnosis, pigmented tumors compose the largest group of tumors in this series (approximately 35 percent). The nomenclature of these tumors is hopelessly confused. While preponderantly benign, a small proportion are malignant and display a tendency to recurrence and metastasis. There are no reliable criteria for accurate classification of benign and malignant tumors, but any pigmented tumor must be regarded as at least potentially malignant. The author suggests that these tumors be sent to the American Institute of Pathology for detailed and consistent histologic study, so that the aggregate experience will enable us to draw more definite conclusions regarding the clinical classification, treatment, and prognosis.

J. Hewitt Judd.

Givner, Isadore. **Benign melanoma of the ciliary body.** Arch. of Ophth., 1940, v. 24, Aug., pp. 347-351.

This condition was found during microscopic examination of globes removed at post mortem from a 63-year-old woman. The findings are described and illustrated with photomicrographs. The author discusses the theories of origin of these tumors and the possibility of malignant changes.

J. Hewitt Judd.

Harbart, Fred. **Malignant melanoma of the orbit.** United States Naval Med. Bull., 1940, v. 38, July, p. 378.

A case is reported in which a melanoma of the choroid ruptured the eyeball of a 42-year-old Samoan woman and then grew to a very large size protruding markedly from the orbit. The mass was removed by exenteration of the orbit and three years later there was no evidence of recurrence.

Ralph W. Danielson.

Jensen, J. P. **Conjunctival lymphoma.** Acta Ophth., 1940, v. 18, pt. 1, p. 67.

Jensen reviews the literature and reports the case of a man 32 years old who had a neoplasm in the nasopharynx, and masses within all the eyelids. The blood picture was normal. The microscopic picture of the excised tissue was lymphoma. (Illustrations.)

Ray K. Daily.

Lucké, B., and Schlumberger, H. **Effect of temperature on growth of frog carcinoma. 1. Direct microscopic observations on living intraocular transplants.** Jour. of Exper. Med., 1940, v. 72, Sept. 1, p. 321.

The authors conducted experiments using carcinoma of the leopard frog injected into the anterior chamber of frogs of the same species. The growth of carcinoma was observed at minimum and maximum temperatures suitable to the environment of the frog; namely 7°C. minimum and 28°C. maximum. The rate of growth was found to be

increased directly as temperature was increased. At the higher temperature there was more efficient vascularization and the tumors formed long branching, tubular outgrowths and cysts. At lower temperatures the outgrowths were short and stubby and cysts were rare. These differences were accentuated by repeatedly passing the tumor from one generation to another. The tumors exposed to higher temperatures regressed more rapidly than tumors exposed to lower temperatures although in both instances there was a definite cycle of growth and regression. Hibernation temperature of 4°C. for long periods of time produced no injury to the tumor. (Photomicrographs and illustrations.) Morton Cutler.

Lucké, B., and Schlumberger, H. **Heterotransplantation of frog carcinoma: character of growth in eye of alien species.** Jour. Exper. Med., 1940, v. 72, Sept. 1, p. 311.

The authors describe success in transplantation of kidney carcinoma of the leopard frog into the anterior chamber of the green frog and the bull frog in 62 percent of the experiments. In the toad there were 37 percent successful transplantations. In fish and alligators no progressive growth of tumor was obtained although in the fish characteristic tumor acini persisted and a few mitoses were found after implantation. The success of transplantation into alien species decreased as the relationship to the original species became more distant. Inflammatory reaction occurred only in eyes of reptiles and fish. Character and rate of growth were followed by continued microscopic examination of tumor growth and were found to be practically the same in the eye of alien species as in the original species. (Photomicrographs.)
Morton Cutler.

Nastri, F., and Basile, G. **A rare case of primary tumor of the optic disc.** Boll. d'Ocul., 1939, v. 18, Oct., pp. 796-810.

Some time after a head trauma, a man of 47 years noticed a defect of central vision in the right eye. By ophthalmoscopic examination, a cyst-like formation of pinkish color was seen covering part of the disc and protruding in the vitreous. This formation increased in size until glaucomatous symptoms developed which required the enucleation of the eye. The neoplasm appeared to be of vascular nature and originated from the papilla. The histologic examination which is described in detail revealed it to be an angioendothelioma. (Bibliography, 6 figures.) M. Lombardo.

Pieck, C. M. F. **A so-called myoma of the ciliary body.** Ophthalmologica, 1940, v. 99, May, p. 471.

A woman of 52 years had a detached retina, and an intraocular tumor was suspected. Histologic preparations revealed a neoplastic mass of the ciliary body in which cells resembling smooth muscle fibers were found. A diagnosis of probable myoblastoma with embryonic cells or a mixture of myoma and fibrosarcoma was made.
F. Herbert Haessler.

Sironi, Luciano. **A fibromatous tumor of the orbit mixed with a tissue of inflammatory nature.** Boll. d'Ocul., 1939, v. 18, Nov., pp. 881-894.

A girl eight years of age had been affected for two years by a slowly progressive right exophthalmos. She showed a marked ptosis with inability to raise the lid while the eyeball was displaced downward, and limited excursion upward and temporally. The vision was normal. Palpation revealed a firm mass between the upper wall of the orbit and the eyeball. At operation the

tumor appeared to involve the elevator muscle, with adhesion to the periosteum and extensions into the lacrimal gland. The mass proved to be a pure fibroma mixed with tissue of inflammatory origin. No relapses had been noted three years after the extirpation. (Bibliography, 10 figures.)

M. Lombardo.

Terry, T. L. **Malignant melanoma—so-called sarcoma—of uvea. 3. Extension into the optic nerve.** Arch. of Ophth., 1940, v. 24, July, pp. 206-214.

While malignant melanoma does not involve the optic nerve frequently (12 out of 94 cases), it is of clinical importance because the growth can extend along the nerve into the cranium. Two cases are reported illustrating fatalities as a result of the nerve being cut too close to the eyeball, leaving malignant cells in the nerve central to the neurectomy. Malignant melanoma can reach the optic nerve by the following routes: (1) from the choroid by extension along the retina, (2) by direct extension into the optic nerve through the border tissues of the intraocular canal of the optic nerve, and (3) by metastasis. The neoplasm appears to grow toward the brain more readily along the nerve itself than along the intervaginal space and the meninges. Intracranial extension gives rise to increased intracranial pressure with a defect in the temporal field and later blindness of the uninvolved eye. Intracranial extension can be prevented by removal of a sufficiently long piece of nerve, which may include the interosseous and intracranial portions of the nerve. Exenteration of orbital tissue must be done if there is any possibility that viable tumor cells have been spread through orbital tissue at the time of the original operation.

J. Hewitt Judd.

16
INJURIES

Bakker, A. **Clinical and experimental investigation of ocular injury by saponin.** Ophthalmologica, 1940, v. 99, May, p. 356.

Experience with a patient in whom a minimal amount of saponin accidentally introduced into the conjunctival sac had caused a tremendous reaction, induced the author to investigate the effect of this substance on the eyes of rabbits. Saponin penetrates rapidly and does considerable damage in the depths of the tissues by forming compounds with cell lipoids. This affinity may be exploited therapeutically. Cholesterol ointment, if introduced quickly enough, prevents damage to the eye.

F. Herbert Haessler.

Bakker, A. **Comparative investigations on the reaction of the lens and cornea to infrared rays.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 180-187.

The author discusses the question of cataract formation from infrared radiation in experimental animals as well as in glass-blowers. He takes exception to the belief expressed by Vogt and his school and particularly by Wagner that the lens damage results from direct absorption of the infrared rays which are supposed to pass unabsorbed through the cornea. After mentioning the work of Goldmann, who emphasized the role of the iris in the development of infrared cataract, the writer gives his reasons for attributing the formation of these cataracts to absorption of infrared rays by the pigmented iris. He describes three series of experiments with excised corneas, irides, and lenses, showing that cornea and lens were injured by the infrared rays only when these tissues were covered by iris. In albinotic animals it is possible, and

even likely, that the lens opacities resulting from infrared radiation are produced by the direct absorption of these rays. Because of the external situation of the cornea and its easy cooling as compared with the deeper-lying lens, it is not correct to judge the ability of the cornea to absorb infrared rays by apparent lack of corneal injury in experimental animals.

Charles A. Perera.

Dean, S. R. **Studies in convulsant therapy. 4. The effects of metrazol (pentamethylenetetrazol) on the eye.** Arch. of Ophth., 1940, v. 24, Aug., pp. 316-325.

The various ocular manifestations which are common features of the metrazol paroxysm consist of the following groups: (a) psychic: visual hallucinations and alexias; (b) motor: blepharospasm, blepharoconus, conjugate deviations, and nystagmoid movements; (c) sensory: abolition of corneal, conjunctival, ciliospinal, and light reflexes; and (d) autonomic: mydriasis and hippus. Metrazol stimulates all the components of the nervous system, but in the autonomic division sympathetic manifestations overshadow the parasympathetic and this is especially evident in the autonomic reactions of the eye. When metrazol is applied locally to the eye it acts adrenergically; that is, it produces mydriasis by direct stimulation of the sympathetic nervous system, leaving the function of the parasympathetic nervous system (constrictor) intact. Metrazol produces partial dilatation of the Argyll Robertson pupil, but does not restore its reaction to light.

J. Hewitt Judd.

Haviland, J. W., and Long P. H. **Skin, conjunctival, and scleral reactions in the course of therapy with sulfathiazole.** Bull. Johns Hopkins Hospital, 1940, v. 66, May, p. 313.

Ten cases of skin eruptions and six cases of conjunctival reactions in a group of 78 cases treated with sulfathiazole are reported. The skin reactions are enumerated and discussed. The ocular condition is considered an entirely new type of drug reaction. As far as could be determined no similar lesion has been described with any of the other sulphonamide derivatives. The lesion is a conjunctival and scleral injection restricted mainly to the exposed portions of the bulbar conjunctiva and sclera. In all six cases the marked injection was accompanied by a considerable amount of burning in and watery discharge from the affected eye. In at least three of the cases the eye nearest the light was disturbed either solely or at least primarily. No "after-sensitivity" to light was noted upon discontinuing the use of the drug. The ocular reactions appeared after from 4 to 16 days of therapy. There were no serious sequelae. Conclusive evidence of reaction relationship to light is lacking. F. M. Craig.

Hurtault, J., Lando, M. X., and García Querol, A. **Intraocular foreign bodies.** Arch. de Oft. de Buenos Aires, 1939, v. 14, July, p. 576.

Three cases of intraocular foreign body with cataract formation are reported, the mechanism of production of the cataract being different in each case. In the first patient a fragment of iron had been retained for 26 months in the posterior segment of the eye with cataract formation by indirect action and definite signs of siderosis of the iris and lens. The foreign body was removed with the giant magnet. Seven years later the cataract was extracted by the intracapsular method, the siderosis gradually disappeared, and vision

became normal with aphakic correction.

In the second patient the foreign body was lodged in the lens itself, which gradually became opaque and produced a cataract by direct action. Successful removal of the cataractous lens containing the foreign body resulted in normal vision.

In the third patient the foreign body was lodged in the lens, presenting a typical traumatic cataract and intense inflammatory and infectious process. Surgical intervention was postponed until the infection subsided under local and systemic treatment. The cataract with the foreign body was later removed and the eye became quiescent, with vision of 5/10.

Plinio Montalván.

Mann, I., and Pullinger, P. D. **Experiments on the effect of ascorbic acid in mustard-gas burns of the eye.** Brit. Jour. Ophth., 1940, v. 24, Sept., pp. 444-451.

This article is based on experiments of the authors as compared with findings of Livingston and Walker (see Amer. Jour. Ophth., 1940, v. 23, p. 608). Three experiments are described: (1) application of a minute unmeasured dose of liquid mustard gas in untreated rabbits, the lids being held back for 15 minutes from the time of the application; (2) application of a minute unmeasured dose of liquid mustard gas in rabbits treated with ascorbic acid; and (3) application of an accurately measured dose of liquid mustard gas in rabbits treated with neutralized ascorbic acid.

It is concluded that intravenous injections of ascorbic acid do not influence the progress of mustard-gas lesions of the lids, conjunctiva, or cornea, and that the degree of damage is related to the dose and not to the resistance of the individual animal to the chemical. Identical doses produced almost identical lesions. (Tables, references.)

D. F. Harbridge.

Perera, C. A. **Ocular sensitivity to nupercaine.** Arch. of Ophth., 1940, v. 24, Aug., pp. 344-346.

A 63-year-old woman showed marked edema of lids and conjunctiva following instillation of a 1-to-500-solution of nupercaine. This marked reaction is shown in photographs. Later use of butyn did not produce an allergic reaction.

J. Hewitt Judd.

Posthumus, R. G. **Traumatic internal rupture of the lacrimal sac demonstrated by lipiodol injection and X-ray examination.** Ophthalmologica, 1940, v. 99, May, p. 476.

A wooden splinter caused a temporary posterior fistula of the lacrimal sac. Diagnosis was possible by means of the technique described in the title.

F. Herbert Haessler.

17

SYSTEMIC DISEASES AND PARASITES

Cooke, C. T. **Nematode worm in the anterior chamber of the eye.** Trans. Pacific Coast Oto-Ophth. Soc., 1938, 26th mtg., pp. 141-147.

Cooke reports the second case of nematode in the anterior chamber on the Pacific Coast; the first having been reported 62 years previously. A 42-year-old woman had had a pain in her right eye six months previously which had been relieved by atropine treatment. This time she complained of severe orbital, frontal, and temporal pain. The fact that she had been bitten by a woodtick, many mosquitoes, blood-sucking flies, and culicoids suggested the possibility that blood-sucking insects might have transferred the microfilaria, or she might have acquired the parasite in the micro stage from fish

while on a fishing trip. Fish in this particular region are known to be infested with nematodes.

The right anterior chamber was clear except in the lower half where there was a filaria-like nematode attached to the iris about one third of the distance from the limbus to the pupillary margin. The free end wandered around in the sulcus over the surface of the iris from 3 to 9 o'clock with irregular rhythmic movements and appeared to be about 10 mm. long. The attached end of the nematode was surrounded by a semi-translucent envelope about 2 mm. in diameter, and the author was of the impression that the tail of the worm was caught in an exudate from the anterior surface of the iris. Through a 6-mm. keratome incision in the cornea 1 mm. from the limbus at 6 o'clock the cocainized nematode was removed with iris forceps and recovery of the eye followed rapidly. A diagnosis of Filaria Bancrofti was made.

Lawrence G. Dunlap.

Gunderson, Trygve. **Convalescent blood for treatment of herpes zoster ophthalmicus.** Arch. of Ophth., 1940, v. 24, July, pp. 132-141. (See Section 2, Therapeutics and operations.)

Thygeson, Phillips. **The cultivation of conjunctivitis-producing and keratitis-producing agents on the chorioallantoic membrane of chick embryo.** Amer. Jour. Ophth., 1940, v. 23, Nov., pp. 1217-1228.

18

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Doesschate, G. Ten. **Robert Grosseteste, bishop of Lincoln. On optics.** Ophthalmologica, 1940, v. 99, May, p. 333.

Roger Bacon, Joannes Peckham, and Witelo, usually considered the first European writers on geometric optics, seem to have been preceded by Robert Grosseteste, bishop of Lincoln. He died in 1253, and part of his copious writings deal with optics. He presumably influenced Bacon. He lived in a period when scholars were preoccupied with metaphysics, and when they believed they could reach true understanding by rigorous deduction from accepted principles rather than observation of natural phenomena. To show that Grosseteste was an early student of the subject and endowed with great originality, the author quotes passages from those of his writings which treat of geometric optics.

F. Herbert Haessler.

Faber, E., and Roelofs, C. **Ninety-nine meetings of the Netherland's Ophthalmological Society.** Ophthalmologica, 1940, v. 99, May, p. 253.

The May number of Ophthalmologica is dedicated to the Dutch Ophthalmological Society on the occasion of its one-hundredth meeting. As introduction to 34 articles which fill the pages of the issue, the author gives a brief history of the 99 meetings which the Society had held since it was founded in 1892. F. Herbert Haessler.

Ferree, C. E., and Rand, G. **Optimum working conditions for the eye.** Sight-saving Review, 1940, v. 10, March, p. 3.

Daylight or artificial light closely approximating daylight in color and composition and as similar as possible in diffuseness is recommended. From the standpoint of color many so-called artificial daylights are of more harm than benefit to the eye. The proportion of wave lengths should be well balanced for comfort. Not every blue glass can be used to advantage as a filter for

Mazda light. Commercial blue bulbs are not recommended because their light shows green in excess. The unfiltered Mazda is better than these. Intensity of light values relative to various limits of tolerance in different age groups are given. Glare is discussed. Types, quality, and color of paper and ink are reviewed. F. M. Crage.

Gradle, H. **Incidence and distribution of trachoma in the United States.** Sight-Saving Review, 1940, v. 10, March, p. 13.

The author classifies the distribution of this disease, especially as to the races affected. It is explained that adequate statistics are not available because reporting of trachoma is not uniformly required in the various states. Tables are given showing new cases reported to the Public Health Service in 1937 (exclusive of Indians), and the incidence of trachoma among the Indians by states. Outpatient clinics in southern Illinois have been well organized for the past five years. Because the diagnostic survey work in the remainder of the states is very haphazard the figures presented cannot be accepted as accurate. It may be assumed that there is roughly a minimum of 35,000 cases among the non-Indians and 25,000 among the Indians. Percentage figures are given as to the principal locations of trachoma cases. F. M. Crage.

Greenwood, A. **Thoughts on office practice.** Trans. Sec. on Ophth., Amer. Med. Assoc., 1939, 90th mtg., p. 53.

The paper contains many worthwhile observations and suggestions. George H. Stine.

Grósz, Emil de. **Ophthalmic questions in wartime.** Szemészet, 1940, v. 3, June, p. 24.

During the World War the ophthalmologist, like other specialists, received comparatively late a working sphere adequate to his training. The number of eye injuries was very great, 9 percent of the casualties as compared to 1 percent in the Franco-Prussian war. In the present war the percentage of brain and eye injuries is even greater.

Trachoma was and is a great problem in Hungary. Before the war, soldies afflicted with trachoma were treated for six months in a hospital and were then sent to the troops if cured, or dismissed if the vision was poor. During the World War, when the number of trachoma patients amounted to 8 in 10,000, special regiments were organized and were sent into the field with specially trained physicians. Eventually, according to later survey, 78 percent of the patients were cured, 22 percent needed further treatment, and 1 percent were dismissed. The hospitals were overcrowded. In one hospital alone one specialist had to take care of nine hundred patients. In present-day Hungary the number of trachoma patients is still over 20,000, but the specialty is well regulated, and the army commandeers physicians for a period of two to three years of special clinic training in university eye clinics. R. Grunfeld.

Hitz, J. B. **Methods for visual testing in schools.** Arch. of Ophth., 1940, v. 24. Aug., pp. 221-224.

The results are presented of an examination of 745 school children between the ages of 8 and 16 years by three lay examiners. The methods used were: (1) the Snellen chart; (2) the Betts test graded both according to Betts and according to methods used at Davenport, Iowa; and (3) the au-

thor's group of tests consisting of the Snellen chart at 6 meters, the Duane screen test at 6 meters and 33 centimeters, and the Worth four-dot test at 6 meters and 33 centimeters. It was found that the largest percentage of muscular and fusional difficulties were missed by the Snellen chart, and that the Betts tests were too discriminating and not well correlated with the results obtained from the use of the more generally accepted ophthalmic tests. The author's group of tests strikes a mean between the other two tests.

J. Hewitt Judd.

Jackson, Edward. **The eye and ear in orientation and balance.** Trans. Pacific Coast Oto-Ophth. Soc., 1938, 26th mtg., pp. 133-140.

A discussion of the eye and ear in orientation, balance, and coördination.

Lawrence G. Dunlap.

Lewis, Park. **Ophthalmology's place in the prevention of blindness.** Trans. Sec. on Ophth., Amer. Med. Assoc., 1939, 90th mtg., p. 28.

The author stresses the importance of taking action in the prevention of blindness. (Discussion.)

George H. Stine.

Seidel, E. **The influence of the eye and its function on human psyche and physical make-up.** Graefe's Arch., 1939, v. 141, pts. 2 and 3, pp. 139-150.

Following cataract operation, two patients regained vision after having been nearly blind for twenty and ten years respectively. Seidel describes how the patients learned to see again. Both became much more youthful in appearance and in their outlook on life. There are photographs of each patient before and after operation.

Charles A. Perera.

19

ANATOMY, EMBRYOLOGY, AND COMPARATIVE OPHTHALMOLOGY

Foust, H. L. **An inherited eye defect in the guinea pig.** Amer. Jour. Ophth., 1940, v. 23. Sept., pp. 1000-1013; and Oct., pp. 1146-1155.

Hanström, Erik. **Demonstration of an absorption color curve in the macula of the monkey.** Acta Ophth., 1940, v. 18, pt. 1, p. 21.

Two retinal segments were excised from the enucleated eyes of a dead monkey: the yellow macular segment, and a retinal segment nasal to the papilla. These segments were extracted according to the method of Willstaedt; from the macula a yellow substance soluble in chloroform was obtained, and the chloroform extracts were negative for reactions to carotinoid. Quantitative spectral analysis with the Warburg-Negelein apparatus was performed on a 14-day solution of the fresh macular extract kept in the dark, and on a bleached solution which was analyzed after one week in the dark and one week in the daylight. The fresh yellow solution showed increasing absorption toward the short end of the spectrum with maximums at 400 and 590 mu. In the solution exposed to light these yellow absorption areas disappeared; the curves were also absent in the retinal areas away from the macula. There was no indication of the presence of carotinoid or vitamin A. The yellow color of the macula is probably produced by a lipochrome dye of a different nature.

Ray K. Daily.

NEWS ITEMS

Edited by Dr. H. Rommel Hildreth
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News items should reach the Editor by the twelfth of the month

Deaths

Dr. Lillian Ethel Taylor, Carmel, California, died September 26, 1940.

Dr. Hermann J. G. Koobs, Rogers, Arkansas, died September 3, 1940, aged 71 years.

Dr. David Bigelow Lovell, Worcester, Massachusetts, died September 17, 1940, aged 75 years.

Dr. William Gooderham Cameron, Tacoma, Washington, died October 23, 1940, aged 66 years.

Dr. Ralph Carleton, Springfield, Massachusetts, a former president of the New England Ophthalmological Society, died October 26, 1940, aged 70 years.

Miscellaneous

The Harvard Medical School is announcing the following post-graduate course in ophthalmology for the second half of the current school year: January 6th—Fundamentals of refraction. February 3d—Clinico-pathological ophthalmology. February 17th—Neuro-ophthalmology and perimetry. March 10th—Ocular muscles. March 24th—External diseases of the eye Ocular complications in general disease, and Biomicroscopy, given concurrently. April 21st—Ophthalmoscopy, and industrial ophthalmology, given concurrently. May 19th—Principles of ophthalmic surgery. June 18th—Recent advances in ophthalmology. July 7th—Visual optics and physiology.

The George Washington University School of Medicine announces the following courses in ophthalmology for 1941: 1. Aviation ophthalmology, February 3d to 7th, inclusive. 2. Intensive post-graduate course in ophthalmology, April 7th to 12th, inclusive. The following guest speakers will be present: Dr. James H. Allen, Dr. Arthur J. Bedell, Dr. F. Bruce Fralick, Dr. LeGrand H. Hardy, Dr. Parker Heath, Dr. Peter Kronfeld, Dr. Angus L. MacLean, Dr. James I. Moore, Dr. Joseph E. Moore, Dr. Algernon B. Reese, Dr. Bernard Samuels, Dr. T. L. Terry, Dr. James Watson White, Dr. Walter B. Lancaster, Dr. Allen Greenwood, and Dr. S. Judd Beach. The following staff members of the Department of Ophthalmology of the university will participate: Dr. William Thornwall Davis, Dr. Ernest Sheppard, Dr. G. Victor Simpson, Dr. E. Leonard Goodman, Dr. Ronald A. Cox. 3. Special practical course in ocular surgery, pathology, and orthoptics, April 14th to 18th, inclusive.

For further information regarding these courses apply to the secretary, 927 17th Street, N.W., Washington, D.C.

Societies

The following Latin Americans attended the first Pan-American Congress of Ophthalmology held recently in Cleveland:

Dr. Tomas R. Yanes, representing the University of Havana, Professor of Ophthalmology, School of Medicine; also the Sociedad Cubana de Oftalmologia; official delegate of the Government Hospital, Calexto-Garcia of Cuba. Dr. Alexis Aguero, representing the Government of Costa Rica and the Faculty of Medicine of the Republic of Costa Rica, San Jose. Dr. Rene Hernandez Arias, representing the Division of Ophthalmology, head of the department, Police Hospital, representing the Government of Cuba. Dr. Moacyr E. Alvaro, official delegate of the Society of Ophthalmology of São Paulo and delegate of the Society of Ophthalmology and Otolaryngology of Rio Grande, Brazil. Dr. Juan Font, San Juan, Puerto Rico. Dr. Manuel Anton, representing the Police Hospital of Havana, Cuba. Dr. Guillermo Mona, Santiago, Chile. Dr. Nelson Moura Brasil do Amaral, official representative of the Government of Brazil, president, Society for Prevention of Blindness, Rio de Janeiro. Dr. H. F. Carrasquillo, Puerto Rico. Dr. Ricardo Fernandez, Puerto Rico, President of the Society for the Prevention of Blindness. Dr. Horacio Ferrer and daughter, of Havana Cuba. Dr. Jose Pereiro Gomes, official delegate of the Society of Medicine and Surgery of São Paulo, Brazil, official delegate of the State of São Paulo, Brazil. Dr. Jose Kos, Rio de Janeiro, Brazil. Dr. Carlos Londono, Bogata, Colombia. Dr. Arturo Quevedo, Guatemala City, Guatemala. Dr. Santiago Barrenechea, official delegate of Chile, Santiago. Dr. Cyro Barros-Rezende, São Paulo, Brazil. Dr. Jorge Ramirez-Duque, Panama.

The next meeting of the Congress is to be held at Montevideo, Uruguay, in 1943.

At the annual meeting of The National Society for the Prevention of Blindness on December 12, 1940, four speakers took part in a presentation of "The heritage left to coming generations by Dr. Park Lewis": 1. As an ophthalmologist, by Dr. Elliott B. Hague. 2. As an internationalist, by Mr. Lewis H. Carris. 3. As a founder of the Lay Movement for

Prevention of Blindness, by Dr. Ellice M. Alger. 4. As a friend of humanity, by Mr. Charles Pascal Franchot.

Personals

On the evening of Tuesday, November 12, 1940, the members of the New England Ophthalmological Society and friends tendered a dinner in honor of Dr. Walter Lancaster. Approximately 45 guests were present, and, after brief laudatory remarks by a few speakers, Dr. Lancaster was presented with a handsome barometer, suitably engraved.

On May 16, 1940, the Cuban Government presented to Dr. William Thornwall Davis the Order National de Merito Carlos J. Finlay in recognition of his research on the theory of the transmission of yellow fever by the mosquito. This work was done during Dr. Davis's service as captain in the Medical Corps of the United States Army in Cuba in collaboration with Dr. Finlay.

On Thursday evening, November 14, 1940, Dr. Edmond E. Blaauw was honored by his friends at a dinner in the Saturn Club, Buffalo, New York. Dr. Blaauw presented an original paper on "Glaucoma capsularis." In introducing Dr. Blaauw, Dr. Fowler, the president of the Buffalo Ophthalmologic Club, said that it was 49 years ago that Dr. Blaauw received his M.D. degree, after having completed his thesis on "Trachoma." Since then he has published 32 papers and when the present paper is published it will be the 33d. He was the first to bring the slitlamp into routine practice in ophthalmology, in about 1912, and for a time he was the national authority in this field. He has always been a student of ophthalmic literature and is a recognized authority. He has practiced ophthalmology in a manner that has won for him the highest possible respect of his colleagues. He was chairman of the Section on Ophthalmology of the New York State Medical Association in 1921.

The paper which Dr. Blaauw presented was based upon the previously written articles on Glaucoma capsularis, and also incorporated some original work on the pathology of the material which breaks off the lens capsule. He plans to publish this valuable information soon. Dr. Cornel Terplan, pathologist of the Buffalo General Hospital, who aided Dr. Blaauw in his investigations, was present and discussed the subject. A number of slides of microscopic sections were shown.

Dr. Ralph Lloyd, recent president-elect of the American Academy of Ophthalmology and Otolaryngology, was present to discuss the paper, and paid tribute to Dr. Blaauw and all that he has contributed to ophthalmology.

The following resolution, engraved on parchment, was presented to Dr. Blaauw:

"Whereas, Edmond E. Blaauw has been a member of this club from the time of its founding in the year 1902, has faithfully performed all duties assigned to him at all times, and served as president in 1929 and 1930; and

"Whereas, He has, by his scientific papers and investigations and knowledge of ophthalmic literature, excited our genuine admiration and stimulated our own scientific interests; and

"Whereas, We know him as a friend, fellow member, and dean of Buffalo ophthalmologists; therefore

"Resolved, That we bestow upon him a membership in our club for the rest of his natural life, and present him with a copy of this resolution at a dinner given in his honor."

Lieutenant Benjamin N. Ahl of the Naval Medical Department recently completed an 18-months' post-graduate course in ophthalmology in Western Reserve University School of Medicine and the University Hospitals of Cleveland. Dr. Ahl has been appointed to the staff of the United States Naval Hospital, Pearl Harbor, Hawaii, where he will be stationed for two years. In addition to his medical studies while in Cleveland, Dr. Ahl was chief of the local Naval Medical Recruiting Station.

Dr. Joseph H. Ralston has been appointed to the Ophthalmological Division of the University Hospitals of Cleveland.

Dr. John M. McIver of Boston, Massachusetts, was recently appointed junior intern on the Ophthalmological Division of University Hospitals of Cleveland.

At the December dinner meeting of the Cleveland Ophthalmological Club, Dr. Frank Walsh of Johns Hopkins University spoke on "Sacular aneurysm of the brain affecting the eye." Preceding the regular meeting there was a clinical presentation of neurological cases, with ophthalmological interest, by Drs. A. D. Ruedemann, R. J. Kennedy, and G. H. Pumphrey of the Cleveland Clinic Ophthalmological Department. Dr. George W. Stimson of Warren, Ohio, presented a report of a case of meningioma.